

Encyclopedia of South American Aquatic Insects: *Odonata - Anisoptera*

Charles W. Heckman



ENCYCLOPEDIA OF SOUTH AMERICAN AQUATIC INSECTS:
ODONATA - ANISOPETRA

Encyclopedia of South American Aquatic Insects: Odonata - Anisoptera

**Illustrated Keys to Known Families, Genera,
and Species in South America**

by

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“Erythrodiplox fusca, a common species in the Pantanal, Mato Grosso, Brazil.”

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This book is dedicated to my son, Francis Heckman

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Introduction

This work was begun to provide keys to the aquatic insect species known from Brazil. The original goal was to include all genera known from South America and all species from Brazil, but for most groups, the scope was expanded to encompass all species in South America, and, in some cases, to include terrestrial species of orders comprising both terrestrial and aquatic taxa. In no case is a taxonomic revision of any group undertaken, although recommendations for such revisions are included where appropriate, and probable synonymy of nominal species still treated as valid in the literature is noted.

Two different approaches will be employed according to the taxon being treated. For phylogenetic groups encompassing overwhelmingly or exclusively aquatic species, such as the orders Plecoptera and Ephemeroptera or the families Dytiscidae and Culicidae, keys are provided to distinguish all genera and species known to occur in South America. An effort has been made to include every identifiable species so that the user of the key can determine with reasonable certainty whether or not his specimen belongs to a species that has already been described or whether it is one that is not yet known to science. Where feasible, complete keys will be prepared for groups containing both aquatic and terrestrial species that do not encompass an extraordinarily large number of species. This has already been done for the order Collembola.

The second approach will be used for aquatic species belonging to predominantly terrestrial taxa, such as the order Lepidoptera or the families Curculionidae and Muscidae. In such cases, the number of terrestrial species involved is too great to deal with conveniently. For example, a work confined to aquatic insects cannot include a key to all of the approximately 45,000 weevil species (O'Brien and Wibmer, 1978) or even the portion of its enormous fauna inhabiting South America because only a small percentage of them live in or on aquatic plants. However, without such a comprehensive key, it becomes difficult for a person not specializing in the taxonomy of this group to be sure in which genus or subfamily his specimen belongs. For aquatic species in such groups, a descriptive approach is used. An attempt has been made to describe the morphology completely enough for the non-specialist to recognize his aquatic species. At the same time, descriptions or keys to higher taxa within these groups are provided as necessary so that the aquatic species can be distinguished from the terrestrial ones and phylogenetic affinities of the specimens can be recognized.

The geographical limitations of this work are not strictly maintained throughout. For some genera, keys are provided that include mention or descriptions of species still known only from Central America or Caribbean islands, while for others, the keys are strictly limited to the South American fauna. The choice of comprehensiveness was dictated mainly by convenience. For genera encompassing few species and those that have been revised by competent taxonomists, keys to most or all Neotropical species could easily be provided. In the cases of other genera encompassing poorly described species,

those which have not been reported south of Panama and the Antilles were not included in the keys.

In general, the ranges of the aquatic insect species are very poorly known. The reported occurrences indicate more the locations at which entomologists have worked than the actual distribution of the species. The type specimens of a great many South American species were collected during expeditions to individual regions of the continent, and systematic surveys of the fauna have only been undertaken for a few groups. Among the prominent early collectors was Charles Darwin. Larger expeditions were undertaken during the late 19th and early 20th century. Considerable numbers of species have been described after examination of the specimens collected in Patagonia and South Chile during the early part of the 20th century. In Brazil, Rio de Janeiro and Santa Catarina appear very frequently in the distribution reports due to the extensive collection in those states by F. Plaumann, while many other species were described from Amazonas because of the presence of a large research station, the Instituto Nacional de Pesquisas da Amazônia, at Manaus. Naturally, a great many species were described from specimens collected at São Paulo and Rio de Janeiro, where most of the Brazilian institutes of research are located. Reports from other Brazilian states are generally much rarer, so the ranges of Brazilian species can generally be expected to be much more extensive than indicated by the published reports. Notable research efforts in other parts of South America have resulted in large numbers of species being recorded for Surinam and the Amazon region of Peru. Knowledge of the fauna in other regions varies considerably from taxon to taxon, depending upon the efforts of talented individuals specializing in individual orders or families. Generally, the insect taxa with the greatest impact on public health and agriculture are best known.

For some rarer species in neglected taxa, the ranges are scarcely defined at all. Specimens described during the last century were sometimes reported from "Brazil" or even "South America" without any more exact collecting data. The fact that the descriptions of such species are generally sketchy, at best, makes it doubtful whether they can be recognized again. There is mention in many of the review papers cited in this work about the confusion caused by falsely labelled specimens, incomplete collecting data, and doubt among the collectors about the names of the places from which their specimens originated. Names such as "Chapada" in Brazil frequently appear without mention of which Chapada is meant. This problem will continue to cause confusion in the future as it has in the past.

The problems encountered in systematic biology worldwide are especially pronounced in the Neotropical Region. This is due to the dearth of competent taxonomic studies on the regional fauna. Theoretically, the scientist who needs to know the correct name of a specimen can accomplish this by a procedure that assures a high probability of success, although a good deal of time and expense may be required. The first step in this procedure is the use of a comprehensive key treating the higher taxon to which the specimen belongs. This process is much easier for a specialist familiar with the group than for a person who needs

to know the identity of species being used in physiological experiments or surveyed in synecological studies. In most cases, after the specimens have been identified using the keys, original or revised descriptions listed by the author of the key should be consulted to confirm the identifications. If the available descriptions are so poor that the identity of the species remains uncertain, a comprehensive taxonomic review of the taxon it belongs to must be consulted. If such a review has not yet been published, the specimen to be identified must be compared with type specimens of each species belonging to the higher taxon to which the specimen belongs. These should be found in museum collections.

According to taxonomic convention, the author of a published original description of a new species should designate one of his specimens as a holotype. This type then becomes the standard on which the identifications of all specimens collected in the future are based. The species to which the holotype belongs is then referred to by the name proposed by the author, at least when the same name has not previously been applied to another species.

In addition to the holotype, other specimens believed to be of the same species by the author are designated as paratypes. If a holotype is not available, a paratype can be examined to confirm identifications. If the holotype has been lost or extensively damaged, a specialist revising the taxonomy of the group may designate a lectotype apparently belonging to the species in question. This then replaces the holotype as a standard for recognizing the species, at least until the lost holotype or paratype is found.

Anyone wishing to take the trouble to identify a specimen beyond the shadow of a reasonable doubt should be able to follow this procedure. If his specimen is not the same species as any of the holotypes preserved in museums, he should prepare a description of his specimen and have it published with his proposed name for the new species or give it to a specialist who is interested in doing this.

Unfortunately, the procedures described above often fail to work, especially when South American insects are involved. First of all, keys to identify the species are seldom available, and when they are, they are generally out of date or incomplete for the region being studied. This leaves the researcher with the chore of collecting a large number of original descriptions to match with his specimens. These descriptions are sometimes very sketchy, leaving the reader with no reliable way of identifying his specimen from the available literature. Comparisons with type specimens may not only be difficult in many cases because the types were deposited in museums on other continents, they are often impossible because some authors have failed to mention the name of the museum in which they intended to place their type specimens or because the specimen cannot be found again due to war damage or sloppiness by the curators of the museum in question. Even when the type can be found, it often proves to be in very poor condition, and relatively few paratypes of South American species have been designated that can be examined in the absence of a usable holotype.

Using established procedures for identifying South American insects is made even more problematic by the practice of some authors of describing new species on the basis of only one life stage. Not only have many species been

described by taxonomists who examined only adults, some are known only from larvae. Furthermore, countless species are known only from adults of one sex. While the description of an adult may provide a legitimate basis for establishing a new species, it is difficult to find justification for naming a species based only on larvae. Some authors have designated larvae as the types of species congeneric with others known only as adults. These individuals seemed to be in such a hurry to publish that they deliberately left the arduous task of matching larvae with adults to other researchers.

In practice, convention should dictate which gender and life stage should be chosen as the holotype. For example, adult male chironomids are presently those on which species descriptions should be based. Earlier descriptions of female adults are generally useless for determining a species unless someone has taken the trouble to match the female to a described male. In an ideal system of nomenclature, descriptions of adults of both sexes and of the larval stages should be provided. However, the state of the art still requires specimens to be identified according to partial descriptions of one stage and often one sex. Therefore, before fully workable systems for identifying South American species will be possible, an enormous number of revisions and supplemental descriptions will be necessary. This work is meant as a first step in the process: providing keys as reliable as the available publications permit.

Finally, it is necessary to note that no keys to taxa higher than family are provided in this work. Keys to the insect orders are difficult to prepare and use because of the many exceptions to the general morphological characteristics, such as wingless dipterans and heteropterans as well as ephemeropterans that lack legs. Descriptions of the orders can be found in any number of textbooks on entomology or invertebrate zoology, and most specimens can be quickly assigned to the correct higher taxon by browsing the volumes of this series and comparing them to the illustrations. With a little experience, anyone can learn to recognize the order of an insect almost at a glance.

An appeal for quality in taxonomic work

This appeal is addressed to two groups, the first consisting of those responsible for deciding who obtains what portion of the available research funds and the second being the taxonomists themselves.

It has long been recognized by experienced ecologists that identification of the species present in a community is an absolute necessity for thorough ecological research. The biota of any water body, for example, is more than a quantity of "biomass" or a "pathway for energy". Many ecologists, especially those beginning their research careers, have the greatest difficulty in identifying the species present, and the quality of their work is limited by this difficulty. The ecologist may indeed investigate systems using methods very different from those engaged in descriptive biology, but he is nevertheless dependent on a sound basis of taxonomic information for the proper reporting of his results.

Briefly stated, ten may be equal to ten, but ten oranges are not equal to ten cows, and ten of one dragonfly species are not equal to ten of another. The “emergency measure” of identifying a species only as far as the genus or family is not satisfactory because two congeneric species may have completely different habitat preferences, feeding habits, and seasonal activity cycles. In short, for one ecologist to properly compare his work with that of another, he must know the name of the species he has encountered and of those that have influenced the biotic communities he has been studying.

In the past, ecologists usually relied on taxonomic specialists to identify their specimens. Since the specimens invariably belonged to a wide variety of taxa, they were distributed among a number of taxonomists, each of whom was an expert only for his own small phylogenetic group. This practice has ceased to function in recent years because of the failure of those in charge of distributing research funds to support scientists who wish to engage themselves in taxonomic work professionally. As the taxonomists reached retirement age, they ceased active research without being able to pass their knowledge on to successors. As time went on, more and more personal knowledge and skill that is difficult or impossible to get from books was permanently lost.

The disappearance of the best taxonomists was accompanied by a decline in the quality of ecological work. This may not be considered totally undesirable by persons in government and business who are constantly confronted by the demands of environmentalists. As ecology moves increasingly out of the laboratory and into the courtroom, the ground rules change, and where principles remain unclear, the lawyers have more room to maneuver, using their skills of persuasion rather than being forced to confront research results already proven beyond the shadow of a reasonable doubt. Furthermore, laws passed to protect endangered species can be better circumvented if no people can be found who are capable of identifying such species.

Although there may well be incentives to suppress taxonomic research, the virtual demise of taxonomy as a field of biology has been instigated mainly by the scientific community itself. Ambition and the desire for quick success have motivated the staffs of many institutions to seek persons promising to achieve great breakthroughs, and no place was left for routine systematic work, which is by nature slow and methodical. Often, it was the number publications rather than their quality or length that determined whether or not a person could succeed in finding gainful employment in science. Recently, science citation indices have become the criterion for judging success, prompting young researchers to investigate whatever everyone else is investigating in order to assure themselves of a maximum number of other scientists who would have reason to cite their work. Pressure was placed on the young scientist to come up with something clever very quickly, leaving no time to learn in depth about the organisms he was encountering. It is especially unfortunate that the worldwide elimination of taxonomist positions came just prior to the development of computer equipment that makes it very easy to establish data banks. Thus, science was robbed of the personnel competent to systematize and disseminate the great body of

information that had accumulated during two centuries of intensive work by systematic biologists in all parts of the world.

A long time went by without any crisis becoming evident because the taxonomists and systematic biologists already working in the museums and universities continued donating their time to help identify specimens collected or used in the laboratory by ecologists, physiologists, geneticists, and biochemists. Even after their retirements, many continued contributing time to help younger colleagues in other fields of biology. Moreover, a number of excellent specialists were employed in other fields of work rather than in the biological sciences and made their contributions to the knowledge of the world's flora and fauna as a hobby.

With the gradual elimination of the competent taxonomists and systematic biologists through death or disability, however, the problems of defining community structure, determining species diversity, and identifying the organisms causing some problem in the field have been intensifying. For many taxa, there are no longer experts who can be consulted, or those experts that are still active are hopelessly overworked.

The result is the loss of a vast body of information about the flora and fauna in all parts of the world. Without knowledge of the species that have been encountered, the ecologist is faced with a dilemma. He must learn to identify a vast array of species belonging to the widest variety of phylogenetic groups, or he must limit his research to superficial phenomena. Hence there has been an increasing tendency to use numbers instead of names and to try to equate quantities of unlike and undefined substances or objects, although this cannot yield any reliable results, as mentioned above.

The second aspect of the problem must be dealt with by the taxonomists themselves, who have in the past often been guilty of laxity in quality control of their work. The ambition to gain status by naming new species has certainly been a motivating factor for many of these scientists, and for this purpose, it is easier to write short papers with sketchy descriptions of aberrant specimens than to produce comprehensive reviews compiling the available information on genera or families together with thorough, well illustrated descriptions of new taxa. As mentioned above, it is evident that the examination of type specimens for positive identification of South American insects is often impossible because none were designated, or if they were, they have been lost or greatly damaged. For better or worse, the published literature frequently provides the only criteria for identifying species.

While compiling this key, the enormously broad spectrum of quality in the taxonomic publications became evident. Some papers are of very high quality, such as the works of Belle on the Odonata. These publications provide descriptions of all essential morphological characters, the exact locations of type specimens, and precise collecting data. Any morphological details lacking in the text can be seen in the detailed illustrations. It is clear from these publications that the species described are distinct from all other known species.

In general, more recent publications tend to include better descriptions than older ones, but this is not the case with all taxa. Many works more than a century old are still useful for identifying species, and some of the information they provide cannot be found in any more recent publications. On the other hand, many recent publications are extremely poor, providing either very sketchy descriptions or showing a very poor comprehension of the concept of species as a closed phylogenetic grouping of individuals, which may possess a considerable degree of individual variability (Mayr, 1963).

Many of the better taxonomic publications are rather long, but length is no guarantee of quality. There are some excellent concise works, which can be used with great reliability for the identification of species. Some very long works, including incredible amounts of detail, on the other hand, are very poorly organized and omit much essential information while including vast amounts of trivia. Authors who are more collectors than biologists have used very keen, practiced observation abilities to find the most minor differences among single populations to produce massive numbers of nominal species that are indistinguishable to less skilled observers. Among the European fauna, long lists of synonyms attest to the vast amount of printer's ink that has been squandered on the description and suppression of spurious taxa. Unfortunately, revisions of many South American taxa are still lacking, and many of the nominal species included in the keys will certainly prove to be junior synonyms when more is known about the variability of natural populations.

In the following sections, minimum criteria will be suggested for describing new taxa. All of the features an author should describe to define a new species or subspecies within a particular taxonomic group will be mentioned. It is further suggested, as a general rule, to base descriptions on a holotype and several paratypes. New species described from only one or two specimens should be regarded as questionable, particularly when the morphological differences between them and specimens of other nominal species are very slight. The practice of choosing type specimens that are missing various structures, such as legs, abdomen, or antennae, should be strongly discouraged. With modern means of mass transportation available, there should be no serious obstacle to collecting more material from the locations at which the type specimen of the alleged new species was encountered, and funds should be provided for such collecting for the reasons outlined above.

It would probably be justified to declare many names of species poorly described and without known type specimens as *nomina inquerendae* and omit them from the key. However, whenever distinctive features were found in the original description that can be used to distinguish a species from all other known species in the genus, the name was included in the keys. Names from the keys must therefore be used with caution because one or more undescribed species may also have the characteristics in question. Consulting the original description cited in the bibliography is recommended, but many of these descriptions are too sketchy to be of much help. Where such situations are apparent, it is hoped that specialists familiar with the genus or family, if any are

presently active, will designate lectotypes for the species most likely to have been referred to by the earlier authors. Holotypes, paratypes, and original descriptions should be provided for any similar, congeneric species that were hitherto undescribed.

Scope of the work

The families recognized are mainly those found in the key of O'Brien and Wibmer (1978), and some of the new families that have been described by various authors after the appearance of that key are omitted because they have not been generally accepted, are too poorly defined, are too similar to other families to recognize any general definitive characteristics for use in the key, or seem for another reason to be of doubtful validity.



Fig.1: The geographical scope of this work is limited to continental South America and the offshore islands shown on this map.



Fig. 2: The Brazilian states where the species were found are generally reported as shown on this map. Older reports, however, may not reflect the modern political boundaries, so it often requires knowledge of the travels of entomologists to determine the precise locations of known occurrence. D.F. designates the Federal District of Brasília.

Geographically, the work is limited to continental South America and islands very close to the coast, such as Tierra del Fuego (**Fig. 1**). Islands far enough offshore to be zoogeographically distinctive, such as the Galapagos Islands, are not included, even though politically, they are parts of South American countries. Except in the case of Brazil, the distribution reported in the keys usually refers only to the country in which the species have been found. When they have been reported in the literature, the Brazilian states are shown, as depicted in **Fig. 2**. However, some inaccuracies may have been inadvertently introduced in the cases of states which have changed their boundaries since the insects were described. For example, Mato Grosso formerly encompassed the present states of Mato Grosso, Mato Grosso do Sul, and Rondônia, so species

reported in older literature from Mato Grosso may actually be confined to any one of these three present states.

Acknowledgements

The preparation of these keys required the search of a large amount of literature. A great deal of help was provided in obtaining many obscure or archaic papers by Frau G. Lechner of the Max-Planck-Institut für Limnologie Library in Plön, the staff of the Entomology Department of the Zoologisches Institute und Zoologisches Museum of the University of Hamburg, and the Timberland Public Library System in the State of Washington, U.S.A. Copies of other valuable works were provided courtesy of Senhora Marília Junqueira of the Fundação Centro Tecnológico de Minas Gerais in Belo Horizonte; Dr. Angelo Machado of the Universidade Federal de Minas Gerais in Belo Horizonte, who also provided me with valuable assistance in identifying specimens; Dr. Dennis R. Paulson of the University of Puget Sound, who also gave me important information on the distribution of *Micrathyria* species, Dr. Rosser Garrison of the California Department of Food and Agriculture, and Dr. David Furth of the National Museum of Natural History. To all of them, I offer my sincere thanks.

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Section 3

Odonata

Members of the Odonata are attractive and interesting members of the freshwater community. They are among the largest insects with aquatic larvae that inhabit terrestrial or littoral habitats as adults. Most species have eye-catching markings, and several are among the most beautiful of insects. Some species are strong flyers, and their adults can be found far from water. Others are typically found only near the edge of the water bodies in which the larvae develop. Because of their predatory habits, they are unappreciated allies of mankind, which have certainly saved millions of lives through their control of mosquitoes and other disease vectors and reduced the losses of many wetland crops through their habits of eating a wide variety of flying herbivorous insects.

The approved common name for all members of the order is “dragonfly.” However, many local common names have been adopted. In addition, the common name, damselfly, is sometimes used to designate members of the suborder Zygoptera. In this book, dragonfly is used for all members of the Odonata, following the recommendation of Gloyd and Wright (1959).

The Odonata is considered to be a relatively primitive group of insects, which is well-represented in the fossil record since the Palaeozoic. Some of the extinct species resembling dragonflies and classified in a separate order, Protodonata, were much larger than any of the modern species. Fossils of these species date from the Upper Carboniferous and Permian. Species in the modern groups of Odonata were common throughout the Mesozoic (Riek and Kukalova-Peck (1984). Bechley (1996) reviewed the various classification systems developed according to the arrangement of the wing veins of both modern and ancient species. From the information presented, it is apparent that the Odonata had arisen as a distinct group of insects not long after winged species first appeared on earth. Their basic morphological structure and the organs modified for mating are unique among the insects. Furthermore, few insects can match the flying abilities of anisopterans, especially with regard to the duration of their flights. Only soaring birds regularly match the time spent in the air by the large aeshnids. At the same time, however, the dragonflies are capable of speed and maneuverability usually matched only by animals that usually fly only short distances at any one time, such as dipterans and insectivorous birds.

All known species of Odonata are predators as adults and larvae, and as such, they are very valuable for providing biological control over many harmful insects, especially those with aquatic larvae. Unfortunately, in spite of their contribution to the biological control of many pests, some dragonfly species have been decimated by pesticides and other toxic substances used in and near water bodies, and some have been permanently reduced in number due to the drainage of wetlands and destruction of small ponds (Heckman, 1981; Caspers and Heckman, 1982). These losses undoubtedly reduce the capacity of ecosystems to limit pest populations by natural processes very severely.

Recently, dragonflies have been subjected to various control measures because they are thought to cause losses among hatchling fishes in aquaculture facilities (Santos *et al.*, 1988). Generally, only the largest dragonflies could consume many hatchling fishes. Placing screens over the small tanks and ponds in which the tiny fishes are kept to interfere with dragonfly spawning would seem to be a much more economical way of keeping dragonflies out of the water than using insecticides. It would also protect the hatchlings from piscivorous birds. As the hatchlings increase in size, they rapidly become too large for dragonfly larvae to prey upon, limiting the period of time that protection against dragonflies would be necessary. In any case, it could be argued that the small economic gains the fish culturists could expect by eliminating dragonflies would be more than offset by the cost to local public health, especially in parts of the tropics where malaria, yellow fever, dengue fever, and other insect-borne diseases are endemic.

South American dragonfly and damselfly species have traditionally been described from adult specimens. However, the larvae of many species have been described, as well. Being relatively large, colorful insects, dragonflies attracted the attention of collectors early, and much of the taxonomic work on the South American species was completed during the 19th century. During the 20th century, authors were very conscientious in providing illustrations and detailed descriptions. In addition, many specialists compiled systematic reviews of various families and genera during the first half of the 20th century. As a result, the taxonomy of the South American Odonata is relatively well established.

Nevertheless, there have been recent revisions of the rarer families of South American dragonflies, and new species are still being discovered. However, relatively few undescribed species of Odonata will be encountered among South American specimens because their size and conspicuous color patterns make them easy to tentatively identify from a distance, and many taxonomists have been attracted to the group. The discovery of some new species can nevertheless be expected after more remote regions in Amazonia and the Andes are visited by entomologists. Considerable effort in all parts of the continent will still be required to provide descriptions of both sexes of the rarer species and to find and describe all larvae.

The larvae of dragonflies and other insects with incomplete metamorphosis were formerly called nymphs or naiads. In recent years, however, the term larva has been applied to the immature stages of all insects belonging to the Pterygota, that is, insects with wings or secondarily wingless.

Metamorphosis occurs after the larvae have climbed out of the water on emergent plant stems or other objects, usually at night, when they are less vulnerable to predation during the relatively long period of wing development and exoskeleton hardening. Occasionally, emerging dragonflies are observed shortly after sunrise. An emergence while the sun is warming the habitat gives them the advantage of avoiding dew, which can be fatal to the dragonfly if it moistens a wing while it is still expanding.

There are too many dragonfly species in South America to cover in a single volume. This insect order must therefore be treated in two separate volumes, one for the Zygoptera and the other for the Anisoptera. The key and illustrations provided here permit specimens in each group to be easily distinguished at a glance. Refer to the **Morphology** section of this volume (p. 15) for definitions of morphological terms in the key, as well as for a more detailed description of the typical structures observed on members of the Anisoptera.

Key to the suborders

Adults

1. The fore and hind wings are similar in size and shape, and a quadrangle instead of a triangle is present in the basal half of the wing. At rest, the wings are normally held nearly parallel to the body axis. The apex of the male abdomen is characterized by two superior and two inferior appendages (**Fig. 3.1**). The adults are generally found near the water bodies in which the larvae develop.

.....Suborder **Zygoptera**..Volume on **Odonata - Zygoptera**

- The proximal part of the hind wing is wider than that of fore-wing. At rest, the wings are held nearly perpendicular to the body axis. A supratriangle and triangle are present in the proximal part the wings. The apex of the male abdomen has two superior and one inferior appendage (**Fig. 3.2**). Adults of many species are strong flyers, and some may be encountered far from water.

.....Suborder **Anisoptera**

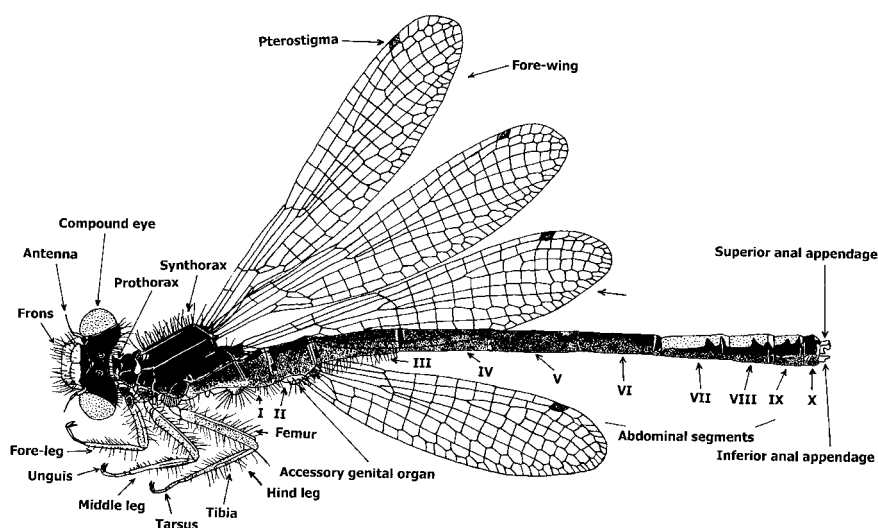


Fig. 3.1 The external morphological structures of *Protallagma titicacae*, a member of the Zygoptera, in lateral view. Based on Kennedy (1939a).

Larvae

1. The gills are externally visible as three flattened caudal lamellae, the longest of which is at least $\frac{1}{3}$ the length of the abdomen, which is cylindrical and not wider near the apex than at the base (**Fig. 3.3**).

.....Suborder **Zygoptera**..Volume on **Odonata - Zygoptera**
 - No external gills are visible. The longest caudal appendage is less than $\frac{1}{3}$ the length of the abdomen, which is usually flattened dorsoventrally and becomes gradually wider from its base to its middle or beyond (**Fig. 3.4**).

.....Suborder **Anisoptera**..This volume

It is noteworthy that there is little chance of misidentifying the suborder of any extant species of Anisoptera or Zygoptera. Generally, members of the Anisoptera tend to be larger, more robust, and stronger flyers than members of the Zygoptera. A few species of Anisoptera, however, are relatively small. Like almost all zygopterans, some anisopterans are almost always found at or near the water's edge, while others fly long distances from water. However, even the anisopterans that remain near water usually fly along the shore periodically in search of food, while zygopterans tend to spend more time resting on littoral plants.

The motion of the wings when flying is also distinctive. In flight, the wings of zygopterans appear to be fluttering, while those of anisopterans are held more rigidly, giving the insect the appearance of a small glider. Most anisopterans fly considerably faster than zygopterans and appear to expend much less effort when hovering in the air. During the day, anisopterans are usually considerably harder to catch than zygopterans.

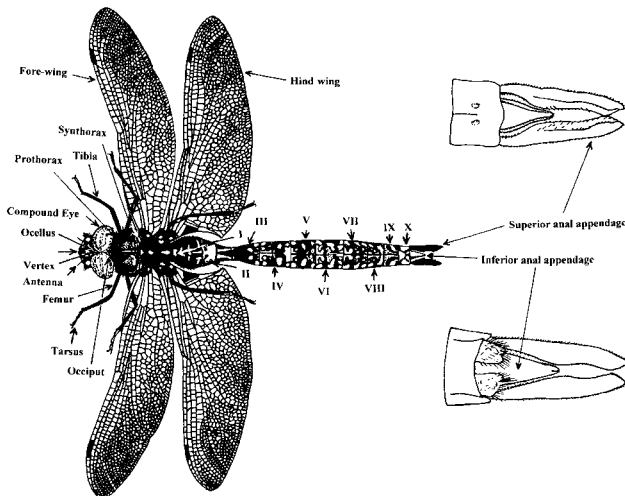


Fig. 3.2 The external morphological structures of an adult *Rhionaeschna diffinis*, a member of the Anisoptera, shown in dorsal view. Based on Mabilie (1888).

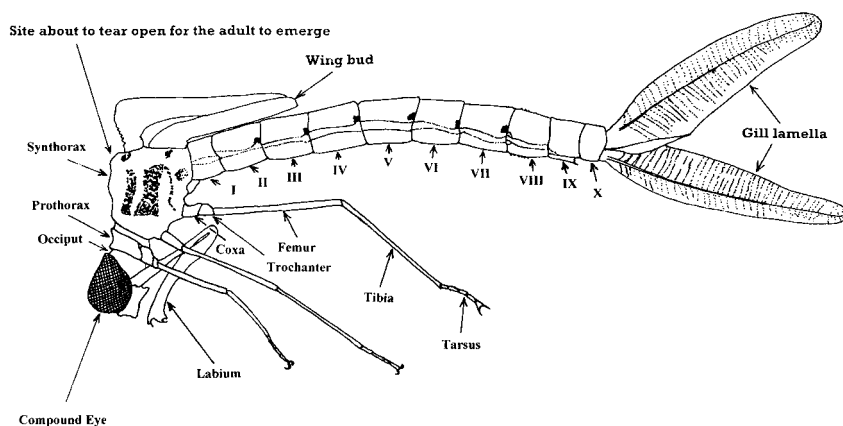


Fig. 3.3 Names of important anatomical structures of the larva of *Lestes pictus*, a member of the Zygoptera, shown on the last instar just at the beginning of the final molt. The exoskeleton is about to rupture along the dorsal midline of the synthorax, which is shown bulging. Based on Santos (1972a).

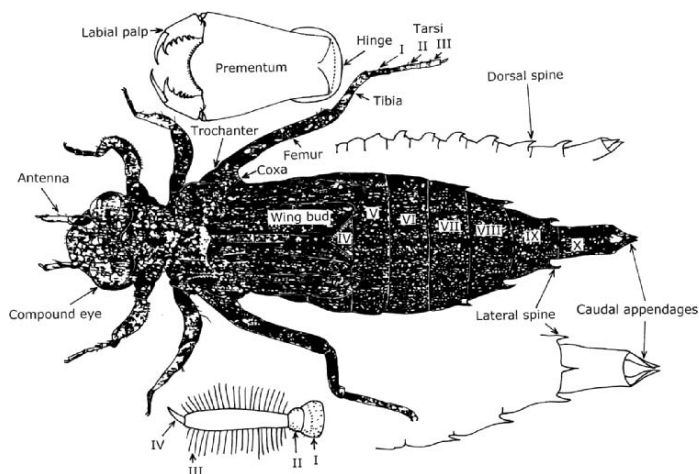


Fig. 3.4 Names of the main anatomical structures of a larva identified as *Peruviogomphus* sp., a member of the Anisoptera. The drawing based on an exuvia of the final instar shows some distortion, although the robustness of the chitin maintains the general form of the larva very nearly as it appeared in life. Other names of some structures frequently appear in the literature, such as “palpal lobes” for labial palps. Near the apex on the outer margin of the labial palp, there is a moveable hook. Some species have a median cleft along the anterior margin of the prementum. Dorsal or lateral spines, or both, are sometimes present on the abdominal segments and have been used as characteristic features to distinguish the species. Based on Belle (1992a).

Section 3, Part 2

Anisoptera

3.2.1 Morphology

Adult dragonflies can usually be recognized at a glance by their robust bodies and elongate shapes. The general characteristics of the order are very distinctive, and there is little chance of confusing them with other insects. A special feature of dragonflies is the location and arrangement of the copulatory organs, which are found on the ventral surface of the second and third abdominal segments of the male and on the ventral side of the eighth and ninth abdominal segments of the female. Mating involves a very complex set of movements, including the transfer of the sperm from the openings of the ducts on the ventral side of the ninth abdominal segment of the male to the copulatory organs with their three-segmented penis in a pit on the ventral side of the second abdominal segment. Copulation with the female begins with the grasping of modified structures on the prothorax of the female by the anal appendages of the male, located at the apex of the abdomen. As they fly in tandem or rest on an object, the female must bend her abdomen ventrad and anteriorly to bring the ventral side of the eighth and ninth abdominal segments in contact with the copulatory structures on the second and third abdominal segments of the male. No other insects have a comparable system for mating.

Dragonflies are apparently among the insects that have developed complex genital structures that prevent interspecific mating. Thus, the individual appendages used during the process are usually ideal for distinguishing the species. These include not only the copulatory structures but also the anal appendages of the male and the lobes and grooves on the prothorax of the female, which the anal appendages grasp.

Other characteristics of the order include an adult head with the mouth directed ventrad and designed for grasping and chewing. The mouths of larvae are highly modified into an organ that can be unfolded and shot rapidly forward to seize prey.

The structure of the thorax is also a characteristic of the Odonata. The prothorax is well developed, while the mesothorax is fused with the metathorax to form a single structure called the synthorax or pterothorax. In the literature, these names are used more or less interchangeably.

The heads of the adults typically bear large compound eyes with facets facing in almost every direction. Three simple ocelli are also present. The head of the larva also bears large compound eyes, indicative of the role visual orientation plays in the predatory behavior of all life stages.

Most larvae creep on the bottom or climb on water plants in search of prey. A few are adept at burrowing into the sediment and may have modified limbs for that purpose. Larvae of Anisoptera have internal respiration. They draw water

into a respiratory chamber located at the posterior end of the abdomen, and many can expel the water so forcefully that they are thrust rapidly forward by “jet propulsion.”

The mouthparts of adult dragonflies are modified for seizing and chewing prey, which they often capture in flight. This method of hunting seems to be the exclusive way of capturing food for many species, particularly large members of the Anisoptera. The fore-legs of all or almost all dragonflies are used to push the prey against the mouth so that the powerful mouthparts can quickly crush the victim and rip it apart. These legs are usually armed with various kinds of robust spines to assist in firmly holding the prey, typically seized in flight. The mouth is also used in defense to bite larger animals that seize them. The labia of the larvae are modified into an organ sometimes called the mask, which can be thrust rapidly forward for seizing prey with labial palps modified for grasping and holding.

There are considerable differences in the modifications of the bodies of anisopteran larvae. Some have legs modified for digging and long extensions of the posterior section of the abdomen, which is extended by the buried larva to the sediment surface to draw in and expel the overlying water for respiration. Some species are benthic and creep over the sediment or objects in the water, while a few climb into submerged plants. The larvae of a few species are flattened in a way to resist rapid water currents and have claws suitable for holding firmly to objects in fast flowing streams.

In addition to the gross morphology, some features of the karyotypes of South American dragonflies have been reported in recent years. Among the karyological findings is an apparent sex determination by an X chromosome, which is present as XX in the diploid cells of females and XO in those of males. Thus, the males of the *Perithemis* species examined have a total number of 25 chromosomes, while the females have 26 (Mola and Agopian, 1985).

3.2.1.1. Adult morphology

The features of the adult usually used for identifying the species include the color pattern, wing venation, shape of structures on the thorax and abdomen, and the genital organs. The terminology for the main external features used throughout the keys for members of the Anisoptera is shown in **Fig. 3.1**. Designations used for the wing veins are shown in **Fig. 3.2.1**.

Except where otherwise noted, the nomenclature used in the keys conforms to that of Chao (1953) and Needham (1903). For a more detailed explanation of the morphological nomenclature, these and some of the more specialized publications cited below should be consulted. In the keys, some parts are referred to by better-understood popular names, such as fore-leg instead of prothoracic leg. It should be stressed that some of the structures used in the figures had been given other names in earlier literature, and additional changes have been proposed recently but not generally accepted. Wherever necessary,

alternative names are defined in the keys when they have frequently been used in comprehensive works. In case of doubt, the figures in the keys should be referred to.

Size and color can often provide a means for quickly identifying a particular species of dragonfly. It is possible for a person familiar with the local anisopteran fauna to immediately identify many living insects in the field from the color pattern alone. However, many species show considerable sexual dichromatism, so the different color patterns of males and females must be recognized separately. Furthermore, the colors of some species change with age. Teneral species are typically pale, and the pigments become brighter as reproduction begins. Senescent specimens of one or both sexes may take on another hue, sometimes strikingly different from that of younger adults.

While it may be possible for a trained observer to perform field studies of South American dragonflies by recognizing the distinctive color patterns of the local species, using color to identify specimens of these insects in museum collections is frequently difficult or impossible. The patterns of some species fade out completely, while those of others remain, but the colors change considerably shortly after the insect dies. This is true whether the specimens are dried and stored pinned in insect cases or preserved in a liquid. It would therefore be useful to produce permanent records of the colors by photographing living insects, as some odonatologists are now doing. Various books for identifying the dragonfly fauna of many European countries now rely mainly or exclusively on color photos of all species. These books can be used in a way similar to many works that are available on the bird or reptile fauna. It is premature to try to produce such a book for the South American dragonflies because there are still probably a considerable number of undescribed species on the continent, and before the photos could be used, the specimens would have to be identified by reference to various anatomical structures. It is not premature, however, to begin compiling a file of photos of living specimens that have been identified correctly to species, and books on the local fauna in specific regions of the continent will probably appear before too long. In any case, a compendium of color photos of all South American species would be considerably more voluminous than one for the European or North American fauna.

After a long period of stability in the nomenclature of the wing veins, a number of major revisions were proposed by several authors, most of which have been reviewed by Bechly (1996). These have produced some conformity between the nomenclature used for Odonata and that employed for the wings of insects in each of the other orders. Unfortunately, there is some disagreement among the authors about how the nomenclature should be applied, and for this reason, none of these new systems are employed in the keys. Nomenclature is most useful when it is stable, allowing a reader to know exactly what an author is referring to. Innovations of the kind being introduced for the dragonflies invariably produce confusion for no better reason than to force others to recognize an author's newest phylogenetic hypothesis.

For several decades, the comprehensive work of Needham (1903) was followed as a standard. For various reasons related to the homology of the veins in the different insect orders, a number of mutually conflicting proposals for renaming them have been introduced, starting with Tillyard (1926). Fraser (1938, 1948a) and Forbes (1943) made additional modifications of the notation according to their own understanding of the evolution of the wing veins. All of the additions and modifications made during the first half of the 20th century were reviewed by Chao (1953). Since then, some authors have adopted the nomenclature of Riek and Kukalová (1984), which will not be further discussed.

More recently, other authors have modified the designations of the wing veins in fundamental ways, and Bechly (1996) should be consulted for a more detailed review. Examples of changes include **CuP** being introduced as a substitute for **Cu₂**, as it has been for other insect orders. Now, newer designations for these same veins are being employed by limited numbers of authors. Therefore, in recent publications, some odonatologists have felt it necessary to cite the authors whose wing vein nomenclature they were using, complicating the job of identifying the species considerably. The confusion created by having to select one of the new, conflicting systems of wing vein taxonomy outweighs the esoteric reasons for change, no matter how important the recent authors deem these reasons to be from their theoretical phylogenetic viewpoints.

The venation of many Anisoptera species is very complex and varied, making it somewhat difficult to recognize by name all of the veins of individual species. However, the great variety of possibilities for their arrangement makes them a feature that has become extremely important in dragonfly taxonomy. Many species can be identified from the wing veins alone, and most families can be recognized at a glance from the arrangement of the veins. Wing vein taxonomy should be learned by anyone who must correctly identify dragonflies, and it should be mastered by anyone working on the taxonomy of this group.

On the wing surface, basal to a location means closer to the wing root, while proximal from means closer to the apex of the wing. Anterior to a location means closer to the leading edge of the wing, while posterior from means closer to the wing's trailing edge.

Fig. 3.2.1 shows the nomenclature of the wing veins conforming generally with the system devised by Needham (1903). An alternative nomenclature based on that of Tillyard (1926) as adopted by Chao (1953) and Hammond and Merritt (1983) is shown in **Fig. 3.2.2**. Caution must be used when interpreting recent literature to be sure which system the author is using. The following discussion is based mainly on that of Chao (1953). Table 3.2.1 shows a comparison of the nomenclature used by the authors prior to 1953, as compiled by Chao (1953). For the most recent proposals, some of which employ esoteric changes in the basic nomenclature, see Bechley (1996).

Certain structures are often used to designate specific locations on the wing surface, and these are used as orientation points on the wing. The terms **nodus**, **triangle**, and **arculus** are examples. These structures are distinctive and prominent in the wings of most anisopterans. The **nodus** appears as a fracture

along the leading edge of the wing, and vein Sc ends just posterior to it. The **triangle** is a structure in the proximal half of the wing bordered by three wing veins, including the **media**. Anterior to it on the opposite side of the **media** is another narrower triangle called the **supratriangle**. Proximal to it is the **subtriangle**. Whether or not each of these triangles is crossed by other veins is important for identifying some species. The **arculus**, often abbreviated as **Arc**, is the posterior fork at the apex of vein **R + M**, which gives rise to the **radial sector**, vein **Rs**, and the posterior sector of the **arculus**. Frequently, authors locate veins proximal or distal to the **nodus** or the **pterostigma**, which is a chitinized cell in the costal field near the apex of the wing, often referred to simply as the **stigma**. It is usually recognized at a glance because of its opacity and color, which almost always contrast with the rest of the wing. In many species, an oblique **brace vein** connects **R₁** to **M₁** at the proximal edge of the **pterostigma**.

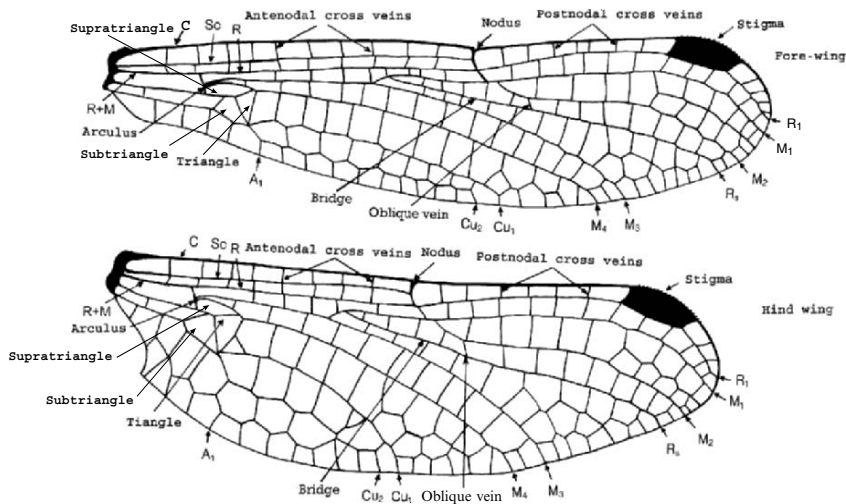


Fig. 3.2.1 The nomenclature of the veins in the wings of *Archaeogomphus infans*. The nomenclature used is that of Needham (1903) as adapted by Borror (1945) in his key to the genera of the Libellulidae: C = costa, Sc = subcosta, R = radius, Rs = radial sector, M = media, Cu = cubitus, A = anal. This nomenclature corresponds to one of those in general use for insect wings. Branches of the veins are numbered from the anterior end of the wing root around the circumference to the posterior root. The edge of the wing is delimited by the costa, which completely surrounds the periphery of the dragonfly wing. Because anisopteran dragonflies have numerous long veins, the numbering becomes complex. Abbreviations, such as R+M and R₄₊₅, indicate that two veins are perceived to be fused and run concurrently. The pterostigma on the dragonfly wing is almost always prominent. The triangles shown here are crossed by bisectors. Some anisopterans have a distinctly-shaped anal loop.

Table 3.2.1 Comparison of the nomenclature and abbreviations used for dragonfly wing veins by various authors. The information was provided by Chao (1953). Selys provided the original names for the veins and used no abbreviations. Designations for minor veins are not shown. The confusion over names and abbreviations has been increasing due to additional modifications in recent years. Whenever possible, rely more on the illustrations than on the descriptions of authors.

Names		Abbreviations				
Selys's name	Chao's name	Needham (1903)	Tillyard (1926)	Tillyard & Fraser (1938)	Forbes (1943)	Chao (1953)
Costa	Costa+subcosta	CC	C	C	C	C
Subcosta	Subcosta	Sc	Sc	Sc	Sc	Sc
Median	Radius+Media	R+M	R+M	R+M	R ₁ Rs+M+Cu	R+M
	First radius	R ₁	R ₁	R ₁	R ₁	R ₁
Arculus, upper sector	Radial sector	M ₁₊₃	—	Rs	—	R ₃
Principal sector	Second radius	M ₁	R ₂	R ₂	R ₂	R ₂
Postnodal sector	Second radius intercalary	M _{1a}	IR ₂	IR ₂	—	IR ₂
Nodal sector	Third radius	M ₂	R ₃	R ₃	R ₃	R ₃
Subnodal sector	Third radius intercalary	Rs	IR ₃	IR ₃	R ₄	IR ₃
Median sector	Fourth+fifth radius	M ₃	R ₄₊₅	R ₄₊₅	M	R ₄₊₅
Arculus, lower sector	Anterior media	M ₃	MA	MA	Cu ₁	MA
Triangle, superior sector	Posterior cubitus	Cu ₁	Cu ₂	Cu ₂	P ₁	CuP
Postcosta	Anal	A	—	A ₁	—	A
Triangle, inferior sector	First anal	Cu ₂	—	1A	1Ax	A ₁
Proximal sub-basal sector	Second anal	A ₂	—	—	3Ax	A ₂

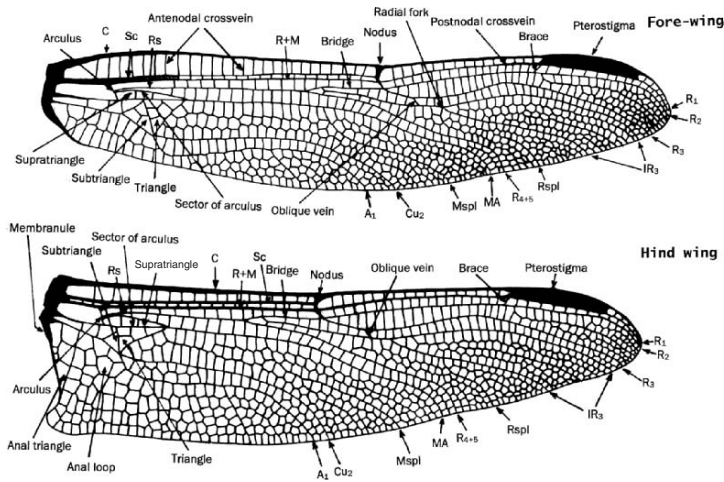


Fig. 3.2.2 Alternative nomenclature of the wing veins of *Cacoides latro*, according to the system of Chao (1953), originally developed by Tillyard (1926).

Other features frequently used to characterize the wings of certain species are the number of **antenodal** and **postnodal** cross veins in the costal and sometimes the subcostal spaces. **Antenodal** describe the cross veins in the costal space proximal to the **nodus**, and **postnodal** describes those distal to it. The **antenodal cross veins** in the costal and subcostal spaces are sometimes paired so that they appear to run continuously from vein **C** through **Sc** to a radial vein, **R**. When a vein runs only through the costal space and has no apparent continuation in the subcostal space, it is said to be incomplete. Two of the antenodal cross veins usually appear thicker and stronger than the others and are referred to as the **primary antenodals** and sometimes designated as **ax₁** and **ax₂**, which is an abbreviation also used for the “**axillary veins**” of Forbes (1943). All other antenodal cross veins are **secondary antenodals**.

The **radius**, vein **R**, runs together with the **media**, **M**, as vein **R+M** between the wing base and the **arculus**. From its origin in the **arculus**, the **radial sector**, **Rs**, appears to run directly to the fork that gives rise to the other branches of **R** and then on to the posterior margin of the wing as vein **R₄₊₅**. Vein **R₁** continues as the upper fork of **R+M** almost to the wing tip, forking just posterior to the nodus to form a short vein joining with the uppermost branch of a double fork in **Rs** to form vein **R₂**. This uppermost branch that joins the fork in **Rs** to vein **R₂** is called the **bridge**. The branch of the double fork between the **bridge** and vein **R₄₊₅** is called vein **IR₃**, one of the intercalated branches of the radius. The cross veins between the bridge and **IR₃** are called the **bridge cross veins**, **br**.

Posterior to **IR₃** is often another long vein arising from weak veins between stronger cross veins and called a **radial supplement**, abbreviated **Rspl**. A similar vein posterior to the media is called the **median supplement**, **Mspl**.

In the hind wing of anisopterans, a group of cells forming the **anal loop** is present proximal and posterior to the triangle. The number of cells in this group, from which the **anal vein**, **A₁**, continues to the wing tip, is another important diagnostic feature. In almost all members of the family Libellulidae, the **anal loop** has a distinctive spear-head, sack, or boot shape, from which the family of the specimen can immediately be determined.

In some species, the hind wing of the male also has a group of cells along the posterior, basal border called the **anal triangle**. The wings of many anisopterans have **membranules** running along the anal border. It is usually prominent only on the hind wing. This **membranule** is usually opaque whitish, but it may also be dark or colored in some species. It is exterior to the costal vein. Its structure has occasionally been used for distinguishing South American species.

As in most other aquatic insects, a primary characteristic of each dragonfly species is the structure of the genitalia and other organs used during mating. The reproductive behavior of many species is complex, involving intricate movements of the abdomen and its special genital appendages. Some species typically mate in flight, and some females spawn with the male still holding her by the head and prothorax with the anal appendages at the posterior end of the abdomen. Many anisopterans deposit their eggs by simply touching the apical segments of the abdomen to the surface of the water to release the emerging eggs. Species that scatter their eggs in this manner usually lack an **ovipositor**. Those species that place their eggs more selectively on plants and other objects usually possess one on the ventral side of the apical abdominal segments. A female may produce from several hundred to as many as 2000 eggs, depending on the species and size of the individual.

The copulatory structures of the male are located in a pit on the ventral side of the second and third abdominal segments. They are often referred to as **accessory genitalia** because they do not produce sperm but rather collect it from an opening on the ventral side of the ninth abdominal segment, requiring the male to bend the abdomen ventrad and bring the ventral sides of the ninth and second appendages in contact to transfer the sperm. The copulatory organs consist of a three-segmented **penis**, a **sheath** resembling a hood, and paired, hook-like **hamules** (Fig. 3.2.3). The nomenclature of the lobes on a penis is shown in Fig. 3.2.4. In some anisopteran species, there is a structure called an **auricle** lateral to the genitalia on each side of the second abdominal segment of the male, which apparently assists the female in finding the male genitalia. The structure of the female for receiving the sperm is located on the ventral side of the eighth abdominal segment. It is marked by an external **vulvar lamina** and often a midline structure sometimes called the **vulvar scale**. Most species lack an **ovipositor** and spawn directly into the water, but some aeshnids deposit their eggs on plants and have well-developed **ovipositors** (Fig. 3.2.5).

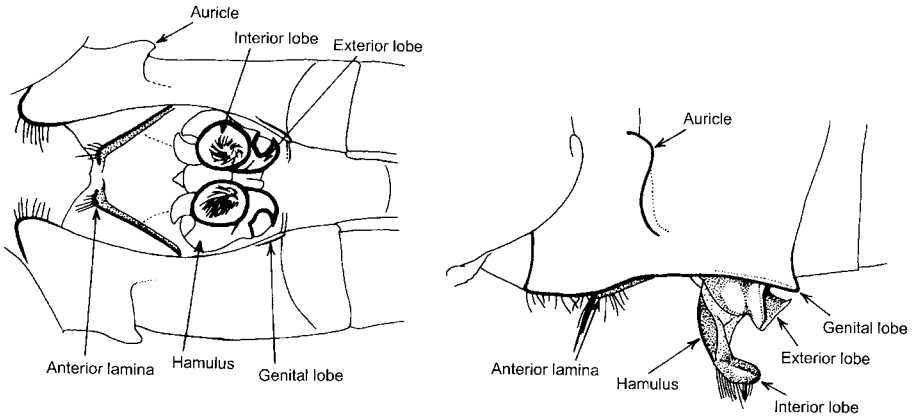


Fig. 3.2.3 The structures of the accessory genitalia on the second and third abdominal segments of a male *Aeschnosoma rustica*, shown in ventral (left) and lateral view (right). Based on Geijskes (1970).

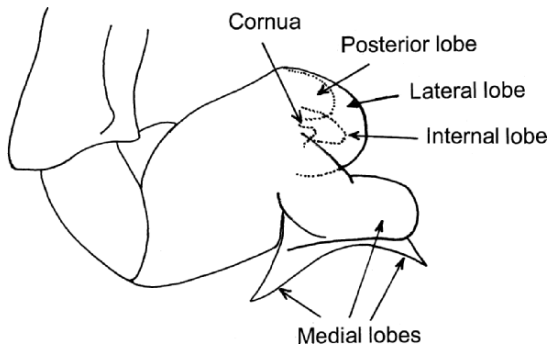


Fig. 3.2.4 Nomenclature used for the penis lobes of *Oligoclada abbreviata*. Based on Borror (1931).

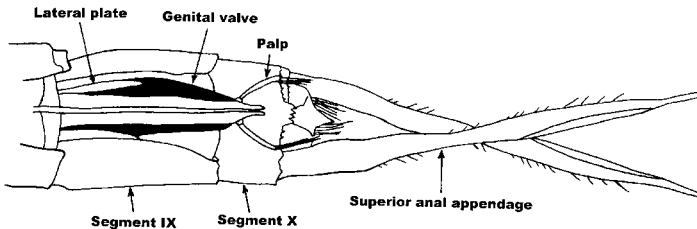


Fig. 3.2.5 Morphological structures at the apex of the female abdomen of *Racenaeschna angustistrigis*, a species with an ovipositor. Based on Calvert (1958).

The appendages at the apex of the male abdomen are modified for grasping and holding the female by processes on the prothorax. They have been called the **inferior** and **superior anal appendages** by most authors, although the superior appendages have been frequently called the **cerci** in more recent publications, while the inferior appendage is sometimes called the **epiproct**. Other names have also been used occasionally for these structures, such as “**caudal**” appendages, although this term is reserved herein for the structures on the larvae. Anisopterans are characterized by one inferior and two superior anal appendages, while zygopterans have two of each.

During mating, the pairs may be seen flying with the male above or in front of the female, seemingly carrying her at the end of his abdomen. Mating occurs when the female extends her abdomen beneath the male so that its genital structure contacts the penis beneath the second and base of the third abdominal segments. These maneuvers appear impressively acrobatic, especially because they are usually performed in flight. The mating of anisopteran species is usually rapid, but individuals of some species will remain attached before and after mating for considerable periods of time.

Because of the complex maneuvers associated with mating, species-specific modifications of certain structures can be found on various parts of the body. In addition to the lobes on the dorsal side of the prothorax, the appendages at the apex of the abdomen of both males and females, and the structures of the accessory genitalia of the male, taxonomists have used the general shape of the abdominal segments, specific markings apparently associated with mate recognition, auricles, and spines or other processes formed on various parts of the body as distinguishing characteristics of species.

Finding the accessory genitalia on the ventral side of the second and third abdominal segments is the surest and quickest way to identify a specimen as a male. Males and females usually differ in numerous other ways, as well. Sexual dichromatism is sometimes marked among the Odonata, and certain spots or other markings are apparently used by the insects as cues for recognizing suitable mates. Young specimens that have already completed the pale teneral stage are usually more brightly colored than older dragonflies that are in the process of spawning or senescent. Senescent specimens of some species take on a bluish or grayish coloration.

Assuming that specific bright markings on one or both of the sexes are used for recognition of a conspecific partner, certain features of the color pattern could be regarded as definitive species-specific characteristics for identification. In geographical regions where the dragonfly fauna is less diverse and better known, such as Europe, color photos can now be relied upon for species recognition. However, before that stage of knowledge is reached in South America, it will be necessary to combine features of the external morphology with characteristic markings to reliably identify the species encountered.

In addition to the features of the wings, genital structures, and color pattern, several other features are frequently used to distinguish the different species of adults. These include the relative lengths of spines on the legs, the presence of

morphological modifications on the head or thorax, and the general shape of the abdomen, as well as the presence of dorsal or lateral spines on some or all of the segments, rows of denticles along some of the segment margins, and leaf-like expansions on the edges of certain segments. The names of structures visible on the head are shown in **Fig. 3.2.6**. The color pattern on some of these structures is frequently used in the keys to help distinguish the species.

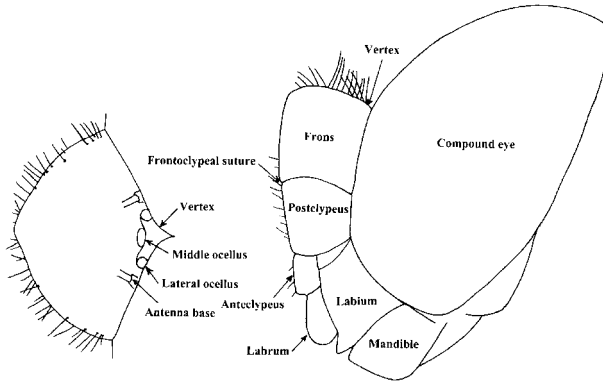


Fig. 3.2.6 Structures on the head of *Racenaeschna angustistrigis*, with the ocellar area shown in dorsal view (left) and the entire head, in lateral view. Based on Calvert (1958) with the nomenclature according to Chao (1953) and von Ellenrieder (2003).

Two divisions of the dragonfly thorax are easily recognized. The anterior part forms a rather narrow band just posterior to the attachment of the head and bears the fore-legs. As in other insects, this is called the **prothorax**. The much larger part of the thorax to which both wing pairs and the two posterior pairs of legs are attached is called the **synthorax** by some authors and the **pterothorax** by others. This part of the thorax consists of the fused **mesothorax** and **metathorax**, which are usually more distinctly separated in other insects. The sclerites of the synthorax, which are chitinous plates fused along more or less distinct sutures, have been given the names shown in **Figure 3.2.7**, and the colored stripes, spots, and bands crossing them are frequently used for distinguishing species. Specialists for the Odonata have developed a diagrammatic method of depicting the color pattern on the **synthorax**, folded open to form a two-dimensional illustration. **Fig. 3.2.7** is typical of such a diagram.

Special attention should be given to the features of each sex since even the wing veins may show considerable sexual dimorphism in a few species. Unfortunately, only one sex of many species has been described, making positive identification of the other problematic. While collecting specimens, remember that mating pairs are particularly valuable for the confirmation that

both sexes really belong to the same species. In observing such pairs, the considerable extent of the sexual dichromatism of many species becomes evident.

Other morphological features sometimes useful for identifying the species include the spines or color pattern on the legs; the color pattern on the wings, which may be variable in some species; tubercles or similar structures on the head and thorax; tubercles and other processes on the abdominal segments, such as the medial ventral tubercle on the first abdominal segment of some aeshnids; the structure of the accessory genitalia and processes on the surrounding segments; the ovipositor, if present; and the color pattern on the abdomen, which is too variable in some species to permit a reliable identification.

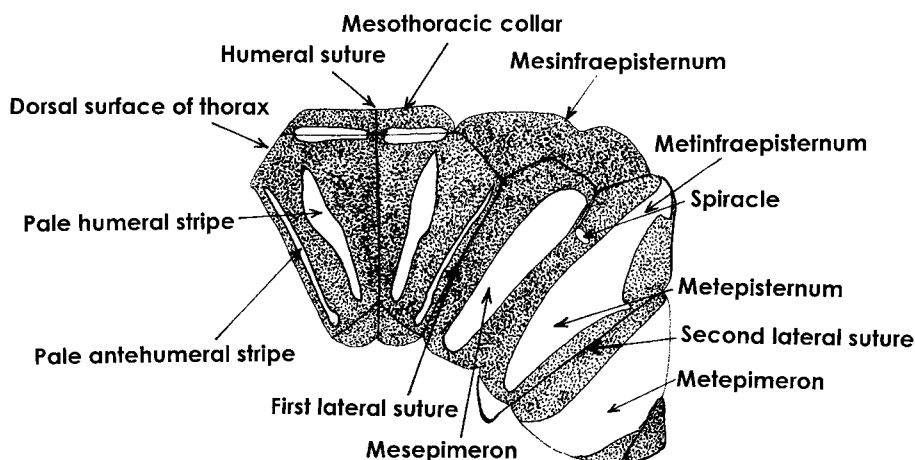


Fig. 3.2.7 Diagrammatic depiction of the color pattern on the synthorax of *Progomphus complicatus*. In this kind of diagram, the dorsum and lateral parts of the thorax are unfolded so that they can be shown on one plane. The dorsal surface is shown at left in dorsal view, and the right lateral and ventral parts are shown on the right of the diagram folded flat. Sometimes a **dorsal carina** is evident along the **humeral suture**. If the pale **antehumeral stripe** is interrupted so that an additional spot is present ventral to it, this spot is called the **antealar spot**. The size, shape, and number of spots and stripes, as well as their color, are frequently used in species descriptions. Based on Byer (1939).

Finally, the size and body proportions provide a means of narrowing the possibilities. However, some dragonflies range considerably in size, and specialists in the taxonomy of South American species have seldom examined enough specimens to reliably assess the size range of each species. Therefore, specimens somewhat smaller or larger than the sizes given in the keys will probably be frequently encountered.

A major problem in determining the size range is the failure of many authors to specify whether the total length and length of the abdomen have been measured with or without the anal appendages. The anal appendages of some species reach several millimeters in length, and their inclusion in the measurements therefore adds significantly to the length. The size reported in the keys is usually taken directly from the descriptions provided by the authors who described the species, so these measurements should be used with caution whenever there is no report on whether or not the appendages were included. After more specimens of each species have been examined, the degree of individual variability will be better understood, and the reported size ranges of the species will certainly increase considerably.

3.2.1.2. Larval morphology

The larva possesses a well-defined head, thorax, and abdomen, typical of species with incomplete metamorphosis (**Fig. 3.4**). Anisoptera larvae have internal gills in a chamber that opens to the outside through a posterior aperture. This shape of the abdomen varies considerably and is a good feature for recognizing various taxa. The posterior segments of many burrowing species are narrowed and elongated to form a tube with the aperture to the respiratory chamber at the apex. While the body is buried in the sediment, this tube extends into the overlying water for “breathing,” that is, expanding and contracting the gill chamber to draw in and expel water.

As already mentioned, many benthic species use the rapid contraction of the gill chamber as a means of escaping enemies. The rapid expulsion of water acts as a kind of “jet propulsion,” which shoots the larva forward and out of danger.

The mouthparts of larval dragonflies are modified into an organ for the capture of prey, sometimes called the **mask**, which is a highly elongated and jointed **labium**, extensively modified from the general insect plan into an organ that can be shot forward with great speed to seize prey. Its **labial palps**, sometimes called **labial lobes** because of their shape, form a powerful grasping organ with **serrae** and strong **setae** that aid in firmly holding the animals captured. At rest, this structure is normally held folded along the ventral sides of the head and thorax. Some structures on the labium frequently used as identifying features are depicted in **Fig. 3.2.8**.

Most dragonfly larvae hunt by remaining motionless as their prey approaches or moving very slowly toward the prey. As soon as it comes within its capture distance, the **labium** shoots forward, and its modified **labial palps** grasp the prey, which is immediately pulled into contact with the other mouthparts and chewed. The palps do not appear as the delicate sensory organs familiar in most other insect groups, but rather as broad opposing plates armed with spines and setae arranged in different ways according to the species. The **labrum** and **mandibles** are compact and robust in order to quickly masticate the prey. Three **ocelli** may be evident, or they may be very difficult to discern because of setae

and aufwuchs coating the head of the larva. The chief organs used for visual tracking of the prey are the large **compound eyes**. As in adults, moving animals small enough to capture and consume seem to be tracked by sight rather than by tactile or olfactory senses. While some species actively hunt, others wait motionless until suitable prey approaches. Anisopteran larvae of more than one family burrow into the sediment. Those breathing through an elongated, siphon-like modification of the caudal appendages that extends above the sediment surface are gomphids.

The number and location of the setae on the **labium** and the shape of the tooth-like prominences on the mandibles are often employed as features for distinguishing the species of larvae. The median basal structure of the **labium**, called the **mentum**, sometimes has a median **cleft** or indentation in the anterior margin of its **prementum**, the name given to its anterior part. The shape and size of this **cleft** and any **premental lobes** that may border it are useful for distinguishing the family or genus of the specimen. The size and shape of the labial palps are also useful for distinguishing the family. Characteristics of genera and species include the number and position of setae on the **mentum** and the **labial palps**, the shape of the **labial palps**, positions of lobes and other processes on the palps, and the length to width relationship of the **mentum** and palps. At the anterior or anterolateral angle of the labial palp is a spine-like structure usually called the **movable hook**. A row of strong setae are usually located between this hook and the base of the palp. The number such setae and the presence and shape of lobes, denticulations, serrations, crenulations, and fine setae are important features for taxonomists. The lobes on the **mandibles** are sometimes useful for distinguishing species, as well. Other characters of the head not associated with the mouthparts that are sometimes employed for identification include the general shape of the head, relative sizes of the individual antennal segments, positions of the ocelli, and distance between the compound eyes.

The structures associated with the thorax that are most frequently used for identification of the species include the shape and size of the **wing buds** and modifications of the legs. **Wing buds** are usually oriented either parallel to each other or divergent. The abdominal segment to which they reach has occasionally been employed as a characteristic for recognizing a species.

Also employed to distinguish various taxa are the number and relative lengths of the tarsal segments on each leg. Modifications of the legs for digging are also important for recognizing species that burrow. Tarsal claws are often described but not very frequently employed in the keys as distinguishing features.

Modifications of the **caudal appendages** for various functions are often among the most distinctive features of larvae, narrowing down the possible choices of taxa considerably. Some authors have used **anal appendages** to describe these structures in the larvae as well as in the adults. The nomenclature of these appendages, as used in the keys, is shown in **Fig. 3.2.8**. The terms **cerci**, **paraproct**, and **epiproct** are used for specific caudal appendages of the larvae in the keys, but not for the adults.

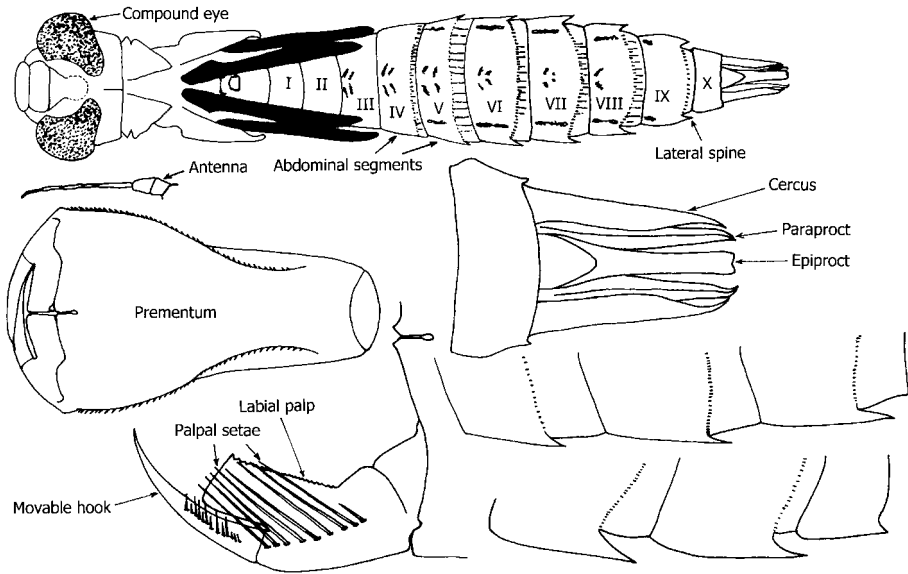


Fig. 3.2.8 *Triacanthagyna caribbea* larva, with names of the common morphological features used in the keys: habitus in dorsal view without legs or antennae (above), antenna (upper middle left), labium (lower middle left), anterior margin of the prementum and a palp (lower left), apex of the abdomen in dorsal view (upper middle right), outlines of the lateral spines on the fifth through seventh abdominal segments (lower middle right), and outlines of the lateral margins of the eighth through tenth abdominal segments. For alternative names, see the text. Illustrations based on Santos (1973a).

The incipient sexual structures are also evident on the larvae. The sex of the last instar is usually easy to distinguish, and the characteristic structures may be sufficient to distinguish some species according to the adult characteristics. Male larvae possess a mid-dorsal caudal appendage posterior to the tenth abdominal segment, while some female larvae develop a prominent mid-ventral process on the ninth segment. This process is particularly well developed when the adult will possess an ovipositor.

For distinguishing the species of larval specimens, the presence, relative sizes, and shapes of **lateral spines** formed at the posterolateral corners of the abdominal segments and middorsal processes, often called **dorsal hooks**, **middorsal processes**, or **dorsal spines** may be important. Some species can be recognized by a characteristic shape of the entire abdomen, which may be cylindrical, flared, flattened, or streamlined in some way for life in lotic waters or beneath the sediment.

The individual larval stages from hatching to the final instar prior to emergence of the adult were described by Rodrigues Capitulo and Muzón (1990a), who identified ten larval instars of *Orthemis nodiplaga*. The development of the labium through this developmental series is shown in **Fig. 3.2.9**. In the keys to the species of larvae, the descriptions should be considered fully accurate only for specimens in the final instar before emergence as adults. Few keys to the larvae include all species, and many lack the majority. A few genera are known only from adults. Describing the larvae of all South American dragonfly species should therefore be a goal given priority by odonatologists.

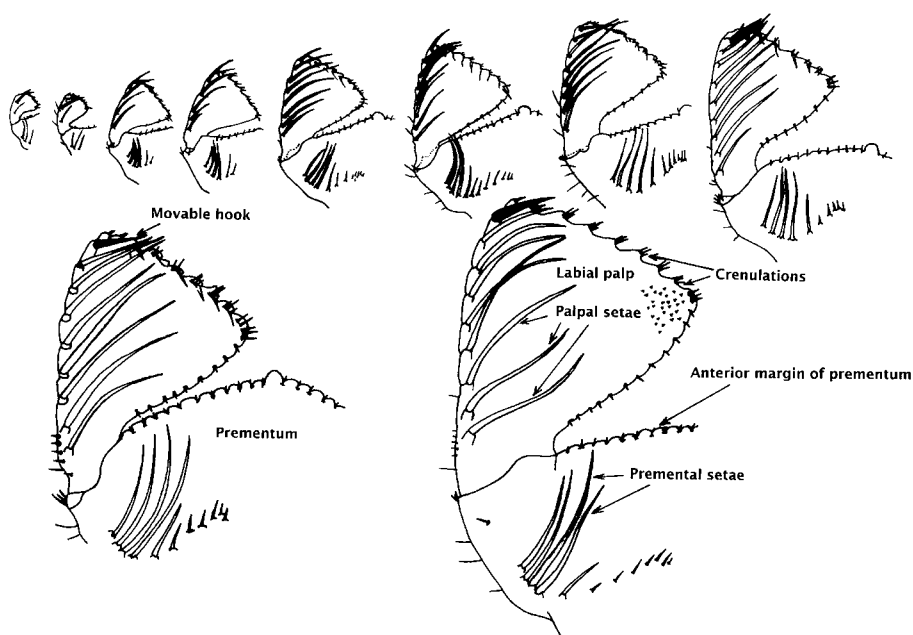


Fig. 3.2.9 *Orthemis nodiplaga* larva: part of the prementum and one labial palp of each larval instar. Based on Rodrigues Capitulo and Muzón (1990a).

Several methods have been used to assign undescribed larvae to the correct species. In some cases, tentative identifications have been made of larvae collected in the field by determining the species of congeneric adults flying along the same water body. If only one species of adult in the genus is found, the authors have assumed the larvae to belong to the same species. If final instar larvae are collected, some general features of the wing can be determined by dissecting the undeveloped wings from the wing buds of the larvae. This method of identification is difficult to use on dragonflies because of the considerable amount of enlargement that occurs in the wings as they

unfold. It is therefore strongly recommended to collect larvae alive and allow them to complete their metamorphosis before preserving them together with their larval exuviae.

In the case of reared dragonflies, a word of caution is needed concerning teneral specimens. After insects molt, they require time for the chitinous parts to harden and assume their normal coloration. This applies both to the individual larval instars and to the adults. Dragonflies tend to require a period lasting from several hours to several days to complete this process, and a specimen captured during the first day or so after molting is likely to be more subject to distortion of the structures used for identification. Because the color pattern is also an important feature for identifying some species, it must be remembered that the colors of teneral specimens tend to be paler. The coloration of many species develops more slowly than the structural features, and the juvenile color pattern is often distinct from that of breeding individuals. Senescent individuals of several species develop coloration quite different from that of younger individuals, and this color pattern will not be visible on any reared specimens that are preserved within a few days of emergence.

In order to determine the natural coloration of the species, it is a good policy to maintain each larval instar and adults alive as long as possible, maintaining them under near natural conditions for at least several days before photographing, illustrating, or describing the color pattern. Keeping a photographic record of color changes would be helpful in determining how the coloration changes during the transition from larva to breeding adult. However, ideal methods of studying insects have seldom been employed by casual collectors in South American, and teneral specimens will be encountered in most collections.

3.2.2. Ecology

Dragon and damselflies form a group of species with rather similar ecological roles. All species are predatory, both as larvae and as adults. All known South American larvae are aquatic, albeit with varying degrees of tolerance for desiccation. Adults have relatively long seasonal periods of flight, requiring active hunting for prey. The positions of the individual species and even the individual larval instars in the food web, however, may be distinct because of the different sizes of the prey consumed and the microhabitats which the larvae inhabit.

Aside from the size preferences, South American dragonflies are not known to discriminate against prey in any way, although more detailed study may reveal that stingers or chemical repellants render some insects unsuitable for food. Their lack of specialization makes dragonflies very useful in controlling undesirable aquatic insects, including mosquitoes and biting gnats, which often form important items in the diet, especially when the undesirable species are abundant enough to become serious pests. The efficiency with which dragonflies hunt and their healthy appetites give them the capability of making noticeable

inroads into the abundance of harmful insects. The positive economic impact of dragonflies in the tropics has often been the subject of speculation but not established by quantitative studies. If appropriate ecological and economic studies are ever undertaken, it is likely that the impact of dragonflies will prove to be far greater than previously thought.

A personal observation in the Pantanal of Mato Grosso provided me with considerable appreciation for the value of dragonflies in mosquito control. During the rainy season, swarms of a large and aggressive mosquito, *Psorophora varipes* (Coquillett, 1904), attack humans and other mammals during the day. These attacks by up to several hundred mosquitoes forced researchers in the wetland to either dress in clothing that covered all parts of the body while the heat and humidity were extremely high or flee the wetland. After one of these swarms emerged from the brush to harass me which I was analyzing water samples, a swarm of dragonflies arrived and began snapping the mosquitoes out of the air, sometimes only centimeters in front of my face. These dragonflies, probably *Erythrodiplax castanea*, were able clear the air of all mosquitoes in only a few minutes (Heckman, 1998a). The destruction of dozens of aggressive mosquitoes by a few dozen dragonflies in a matter of seconds convinced me that the value of dragonflies in pest control is enormous. The effectiveness and economic value of biological pest control certainly deserve careful investigation.

I later noted that the dragonflies in the large swarms followed people and large mammals as they moved through the wetland, apparently awaiting the emergence of the large mosquitoes from the brush to attack large mammalian bait. This is apparently not the first but probably the final kind of attack by dragonflies on the mosquitoes during their life cycles. Prior to attacks during their blood-sucking forays, the mosquito populations had undoubtedly been decimated by other dragonflies hunting around the water bodies from which the adult mosquitoes had emerged. Before that, the mosquito larvae had certainly been subject to predation by any dragonfly larvae that had shared their habitat.

Unfortunately, because the size of the prey rather than its phylogenetic group usually determines which animals dragonfly larvae will feed upon, some large dragonflies are considered undesirable in fish hatcheries, where the fish fry fall within the size range of suitable prey. As discussed in the introductory paragraphs, any measures taken to eradicate dragonflies to protect fish larvae will have negative economic consequences on the local agriculture and public health.

Generally speaking, the members of the Anisoptera are very strong fliers, and some can be encountered very far from water. Dragonfly larvae are found in most kinds of water body, from streams to ponds and even temporary stagnant pools, as well as the water trapped in bromeliads, which has already been confirmed for some zygopteran species (Santos, 1978; DeMarmels, 1985). Many morphological adaptations are observed among the species, which facilitate the survival in the preferred habitat of each.

Adult dragonflies generally have very good vision and use this sense extensively in hunting. As a result, the insects are typically diurnal, flying only during daylight hours. A few species are crepuscular, but at night, flying and hunting cease. The larvae of many species also seem to hunt primarily by observing movement, but there are many species with habits that preclude active hunting. For example, some larvae bury themselves in the sediment and draw in water through an extended caudal breathing tube for respiration. They must wait for the prey to approach before seizing it.

Ecological differences between species include the kind of water body in which their larvae develop, the diurnal activity pattern, and the prey that they most frequently choose. Prey choice seems to depend mainly upon the relative size and availability of the prey. Usually, the larger the dragonfly, the larger the prey. Some species, however, are adept as adults at capturing and killing relatively large prey, sometimes including dragonflies of other species. For feeding on relatively small prey, the fore-legs of some dragonflies are armed with long, close-set setae for trapping flying insects considerably smaller than the predator. Much has still to be learned about specific feeding habits, and some surprises may yet be encountered.

The habitat preferences of South American dragonflies has been studied more thoroughly than those of most other aquatic insects in South America. Studies of various kinds of habitat have yielded lists of dragonfly species commonly found in them. Anisopterans are typically associated more with the preferred kind of habitat than with any particular geographical region. Obviously, being extremely strong flyers, the large dragonflies are able to travel long distances and find new water bodies suitable for spawning. The limitation on their ranges is therefore related almost exclusively to the presence of suitable habitats for the larvae.

Spawning females of many larger dragonflies deposit their eggs directly in the water by skimming the tips of their abdomens across the surface of the water. As already discussed, only a minority of the anisopteran species possess well-developed ovipositors for depositing their eggs on objects, such as water plants. Being rather unselective predators, the larvae are usually not limited by the availability of prey but rather by suitable substrates, such as fine sand for the burrowing species and submerged plants for the climbing ones. They can be eliminated by anaerobic conditions and harmful chemicals, since their gas exchange occurs directly with the ambient water. However, some species are more resistant to poor water quality than others, and short periods of low oxygen concentrations at night will not necessarily eliminate all dragonfly species from a habitat.

Fewer anisopterans than zygopterans can be expected in fast-flowing streams. The great majority of anisopteran species prefer standing or slowly flowing water. However, the larvae of a few species, such as *Limnetron debile*, inhabit mountain streams (Assis *et al.*, 2000).

The great variety of shapes of the larvae reveals suitability for many specific niches within an aquatic community. Many larvae seem particularly well suited

for creeping along the bottom of shallow ponds and lakes, while others are equipped with many elaborate spines and other processes that would seem to make them particularly suited for concealing themselves among submerged water plants. Usually, the habits of the larva can be inferred from the structure of the body and legs.

Fossorial larvae are encountered relatively frequently among anisopterans because their gills are protected in internal chambers. Water bodies with extremely clear water and relatively little organic material are especially suitable for burrowing species because of the availability of oxygen-rich water at the sediment surface and the concealment from predators afforded by this mode of life in clear water. Fossorial habits may also be conducive to survival in water bodies that periodically dry up for short periods, although this will require considerable study in the future to confirm.

Some of the specific kinds of habitat frequented by dragonflies include cool water bodies of the Andes region (DeMarmels, 2001a, b) and in Patagonia (Muzón, 1995, 1997), subtropical wetlands (Jurzitza, 1982a), ponds and rivers in the Atlantic forest (Ferreira-Peruquetti and Marco, 2002), temporary water bodies in the tropical wet-and-dry climatic zone (Heckman, 1998a, b), dry forest areas (Longfield, 1929), the Amazon rainforests (Kirby, 1897; Sjöstedt, 1918; Schmidt, 1942; Machado, 2002; Hamada and Oliveira, 2003), and forests of northern South America (Calvert, 1958; Geijskes, 1964a, b, 1970, 1971; Belle, 1964a, 1966a, b; DeMarmels, 1983a; Machet, 1991). Besides general types, many small, local water bodies and wetlands have special conditions suitable for dragonflies with highly specialized habitat requirements. Much is still to be learned about rare species limited by their specialized habitat requirements.

The individual species not only show habitat preferences, they also display various degrees of tolerance to extreme environmental conditions (von Ellenrieder, 2000a, 2001a). Thus, some anisopterans are limited to well-defined habitats, while others can be found in the widest variety of water bodies. Naturally, the more tolerant species can be found over much greater ranges than the more specialized ones. Thus, a few dragonfly species are found throughout vast areas of the South American continent and in parts of Central America and the Caribbean, as well.

Habitat choice is made by the spawning females, and it is apparently most often regulated by seasonal factors. Hundreds or even a few thousand eggs may be released by one female, so the selection of spawning sites does not have to be very careful. The species without ovipositors or with vestigial ones generally scatter their eggs on open water. Those with well developed ovipositors may attach the eggs to water plants or other objects near the water. In regions with wet-and-dry climates, eggs may be deposited by some species on the drying sediment and mats of small plants in desiccated temporary water bodies, as reported for *Gynacantha bifida* by Bedê *et al.* (2000). The eggs presumably hatch after the areas are flooded at the start of the rainy season. The authors reported that this species produces two generations per year, with the larvae of

one generation developing during the rainy season and the second, during the early dry season.

Another strategy for coping with seasonal desiccation of the habitat is employed by *Pantala flavescens*, which completes its larvae development very rapidly and is therefore able to inhabit temporary water bodies (van Damme and Dumont, 1999). This is apparently responsible for the great success of this species in the neotropics, which is evident from its great area of distribution.

In the colder temperate regions of South America, the life cycle of dragonflies could be expected to be similar to that known from similar climatic regions in Europe, Asia, and North America. This makes it likely that the dragonflies there would spend the winter as larvae and emerge as adults during the spring or summer. However, the life cycles of most species have not been carefully studied. Elucidating the habits of the individual instars in the life cycles of South American dragonfly species will provide a fertile field for future investigation.

3.2.3. Preservation and examination

Adult anisopterans are among the most difficult insects to collect because they are extremely wary and can fly faster than many collectors can swing a large net. This is especially true for large gomphids and aeshnids, which seldom rest during the day and can outmaneuver odonatologists most of the time. Some specialists have even resorted to bird shot to bring down some of the highest flyers, taking into account the damage to their specimens. It is also possible to wait for opportunities to collect certain specimens. Eventually, dragonflies die and can be collected on the ground before scavengers find them. Others are injured by passing automobiles and can be collected along roads. Still others have been captured in spider webs. Early on cool mornings, dragonflies are somewhat sluggish and can be more easily captured in large nets. Personally, I have found dragonflies can be captured more easily just before sundown, when they seem to be somewhat fatigued after a full day of flying. Some odonatologists prefer to collect after rains.

It is considerably easier to capture dragonfly larvae, which can be raised to adults in aquaria. There is little evidence for any kind of food preference by the larvae, and most species seem to consume whatever small animals they can conveniently capture. Few anisopterans seem to be limited to fast-flowing water, and most species can be kept alive in aquaria on a diet of live fish food organisms, such as the chironomid larvae sold under the name, "blood worms," or other small aquatic insects. The advantage of raising adults from larvae is the chance to make positive specific identification of larvae that have not yet been described. The exuviae are robust and preserve the structures necessary to characterize the species.

In the past, adults were usually preserved dry and pinned in insect display cases. This method of preservation is suitable for the great majority of species

because their bodies are robust, but over a period of many years, colors fade and sometimes change considerably. The exoskeleton is tough enough to resist distortion caused by desiccation, so dried and pinned dragonfly specimens look relatively life-like. Unless damaged, the wing veins of dried specimens are also relatively easy to study.

More recently, it has become customary to store preserved dragonflies in small envelopes. Glassine envelopes are often used by collectors in the field, while cellophane envelopes seem preferable for storage in permanent collections. Before placing the specimen in the envelope, the wings should be folded back. In the case of anisopterans, that means folding the wings dorsad in the direction the wings move naturally, so that they are directed roughly 45° from the body axis. At this time, it is also recommended to keep the abdomen straight so that it will harden in this position.

Generally, specialists suggest keeping captured insects alive for a period of time to allow them to discharge the contents of the digestive tract. It is also especially important for adult dragonflies that have been collected shortly after metamorphosis to be kept alive until the chitinous exoskeleton has hardened and taken on its adult coloration. The animal is then killed by placing it in a closed jar with a toxic substance. At the present time, ethyl acetate or acetone are usually preferred because they seem to affect the color pattern less than other substances. However, acetone tends to remove natural pruinosity. Heat from summer sunlight is also used by some collectors to kill the dragonflies.

If specimens are to be pinned, it should be done immediately after the specimen is killed so that its body will adhere to the pin as the body dries. Specimens should not be moved on the pin during the drying process. The pin is customarily inserted through the synthorax slightly to the right of the centerline so that it emerges again along the midline on the ventral side.

Another suitable way to preserve dragonfly specimens is in a preservative. A recommended liquid is ethanol, which may be mixed with a small amount of a reducing agent to slow discoloration and up to 5% glycerine to keep the specimens soft and prevent serious damage in case the ethanol evaporates from the container.

An important advantage of keeping specimens in a preservative is the exclusion of small insects, which can unexpectedly appear in collections of dry insects and destroy them before their presence is even noted. Dermestid beetles are famous destroyers of museum collections, requiring the construction of special storage cases to keep them out. In tropical countries, tiny ants are able to gain access to specimens in seemingly air-tight boxes and eliminate entire collections in a matter of hours. Poisons are often placed in the cases to kill the insects, creating a hazard for entomologists who work many hours with the collection.

These problems have prompted increasing numbers of entomologists to opt for liquid preservatives, even in the case of relatively large insects. The obvious disadvantage of preserving anisopterans in this way is the size of the jars required to hold many large specimens. Too many insects in one jar result in

damage and the losses of parts when they are removed. Therefore, some collectors place the envelopes containing the specimens in the alcohol, which gives an extra measure of protection against breakage on removal.

For small adults and larvae, 96% ethanol may be used with good results, although 80% alcohol is sometimes recommended (Smith and Pritchard, 1956). Even large specimens can also be preserved in this way, but those with especially bright colors can be better preserved dry after treatment with acetone. Under no circumstances should formalin be used as a long-term preservative. It causes distortion of both adults and larvae and eliminates the color pattern of the adults. In addition, adults placed in formalin must first be fully moistened with ethanol to keep them from floating on the surface of the liquid and failing to be effectively preserved. I have often observed the wings or legs of aquatic insects becoming distorted during the preservation process in formalin, making them difficult to examine. For this reason, as well as the health hazards of working with it, I cannot recommend formalin for long-term preservation. However, specimens may be fixed in ether, a mixture of formalin and alcohol, or acetic acid mixtures and then transferred to ethanol as soon as possible after fixation to avoid serious distortion.

Different collectors have their own preferred methods of fixing their specimens. Some recommend placing the specimens in acetone for 8 to 12 hours immediately after killing and then drying them in the air. Large specimens can also be injected in the thorax and abdomen with acetone before immersion. Although the acetone discolors the eyes, it seems to protect most of the other colors. Unfortunately, it makes the specimens unsuitable for DNA studies and analyses of the fatty tissues. It also makes the specimens hard and brittle. Some collectors air dry the specimens without using any chemicals as fixatives. More details can be found in Corbet *et al.* (1960).

Some researchers have been able to conduct field studies of adult dragonflies using binoculars (Dunkle, 2000). To permit such studies to be successfully conducted, it is necessary to recognize the species from easily observed features, such as the color pattern. To facilitate this, photograph catalogs of positively identified specimens will have to be produced for South America. Photographing the dragonflies in the field and then positively identifying them will eventually make it possible to produce field guides. Photography or production of digital images should be given priority in field studies so that field guides can be prepared.

For larvae, fixatives are sometimes used for killing and better preservation. However, whenever possible, larvae should be raised in aquaria until the adults emerge because of the valuable information that can be obtained about their growth and the morphology of the individual instars. The exuvia of each instar should be preserved, either dry or in alcohol, for later study. Unless low humidity can be maintained on a permanent basis, it is preferable to preserve exuviae in ethanol. Mold or bacteria can otherwise attack the chitin if a small amount of moisture is present in the container.

Although the ideal way of eliminating all chance of error is to raise larvae in the laboratory, this is not always feasible. If it is not possible to keep the larvae alive, ethanol is the preferred preservative. While some taxonomists suggest using a 70% or 80% solution, others recommend using 95% ethanol (Edmunds, 1959). My personal recommendation is to use the commonly marketed 96% solution because after specimens with small amounts of water are introduced into the alcohol, the final concentration will usually be diluted to no more than 80%. However, specimens transferred to 96% ethanol show no notable distortions or unusual discoloration. By adding 5% glycerin to the preservative, the specimens are kept somewhat less brittle and are protected from inadvertent short-term desiccation.

Preservatives other than ethanol are not recommended because of the damage they do to the chitin of the exoskeleton. Aqueous solutions, such as formalin, also have a tendency to cause swelling of the specimens and damage to the chitin, although some authors have reported using 2% formalin, disregarding its newly discovered dangers to human health.

For over a century, the great value of maintaining collections of exuviae together with the newly emerged adults for taxonomic study has been recognized (Needham, 1899). Not only for basic taxonomic studies but also for general ecological surveys of aquatic species, exuviae should be collected and preserved in alcohol, whenever possible, together with the adults collected in the field while emerging. It should be remembered that teneral specimens are less than desirable for taxonomic studies, as already discussed. Therefore, the adults should be kept alive until the exoskeleton has hardened and taken on its full coloration and then preserved together with its exuvia. Matching larval and adult specimens greatly facilitate the correct identification of the species and also provide specimens of great value for taxonomic study. Complete series of exuviae from all instars of individuals cultured in the laboratory are of even greater value for morphological studies, permitting the external anatomy of the larval stages and adults of each species to be fully described without problems of mismatching the larvae of one species with the adult of another, as sometimes has occurred during field studies.

As already mentioned, the less satisfactory way of obtaining conspecific specimens of larvae and adults is to collect them in the field and assume that common congeneric specimens probably belong to the same species. Obviously, this results in a degree of uncertainty when using the resulting descriptions to identify specimens. Added to this is the fact that specimens in museum collections are sometimes incorrectly labeled or placed in the wrong containers after examination. Furthermore, in mixed collections of dragonflies taken during general surveys, preserved specimens appearing unusually etiolated and fragile, which had probably just molted before fixation, might appear to be different species than older specimens with normally hardened exoskeletons. It must also be remembered that the color of senescent specimens may be considerably different from that of younger ones.

3.2.4. Zoogeography

As already mentioned in the section on ecology, dragonflies, especially members of the Anisoptera, are less restricted geographically than most other aquatic insects because of their relatively long lives as adults and ability to fly long distances. This permits them to easily colonize any part of the continent where suitable water bodies for the development of their larvae are present. Therefore, zoogeographical barriers on the South American continent are less of a factor in the distribution of the dragonflies than are the ecological tolerances of the individual species.

Based on published records, most South American species seem to be confined to the continent and a few offshore islands. Central America and the Caribbean Islands seem to be inhabited mainly by a distinct dragonfly fauna thought to include surprisingly few species that are also distributed in South America. A few species are nearly cosmopolitan in distribution, and several more have ranges encompassing both North and South America. However, the high percentage of South American dragonfly species thought to be endemic to that continent suggests that there is a Central America and Caribbean zoogeographic barrier that relatively few dragonfly species have succeeded in crossing. It is suspected, however, that more thorough surveys will substantially increase the list of species found in both Central and South America. If this is not the case, the ecological differences between the Central American water bodies and those in northern South America will certainly merit closer study.

Circumantarctic distribution patterns are not very well illustrated by the anisopterans. Only a few species belong to groups confined to the southern continents, and the orders of insects that are not such strong flyers generally illustrate zoogeographical patterns considerably better than dragonflies. Recently, the establishment of the family Austropataliidae and discussions about the status of the family Neopetaliidae have brought attention to the existence of vestiges of a Circumantarctic dragonfly fauna. However, the systematics of these groups is still in a state of flux, and more studies will be required to reveal the phylogenetic positions of the individual species (Lohmann, 1996a, b, c; Carle, 1996; Bechley, 1996).

On the South American continent, the main geographical regions that are ecologically distinct are generally characterized by their own dragonfly fauna. The Andes provide dragonflies with a series of habitat zones running from the foothills up to the high alpine meadows and mountain lakes. The lowlands include the forests of northern South America, the Amazonian rain forests, dry forests, seasonally flooded wetlands, the Atlantic forest, warm subtropical farmland, temperate forests, temperate grasslands, and the cool regions of Patagonia. Each of these regions offers typical habitats for certain species, and each also includes microhabitats that support more specialized elements of the dragonfly fauna. In **Section 3.2.2**, special studies on the dragonfly fauna in some of these regions were listed. It should be noted that a few species are encountered in a great many different regions of South America, while others

seem to be endemic to only one limited geographical location. The picture may change, however, after more information on the ranges of the individual species becomes available. Vast areas of South America have never been subjected to exhaustive entomological surveys.

The cursory range information reported in the keys could be greatly improved by more faunistic studies of the South American dragonfly fauna. It is hoped that the keys provided herein will stimulate such studies by facilitating the identification of specimens collected. Even the little supplemental information provided in the keys on the ecology of many species should help odonatologists estimate their ranges until more accurate information is available based on actual visits to poorly studied regions.

3.2.5. Taxonomic problems

The literature used for the description of South American dragonflies is less frustrating to use than that on many other insect orders, such as the mayflies, because earlier taxonomic specialists provided good descriptions, and many of the 20th century authors included detailed illustrations, partial keys, and well-structured and apparently reliable systematic classification. This is not to say that problems do not exist, but the solutions to them are obvious and will demand only the collection and examination of additional specimens to solve. In some cases, artificial rearing of the larvae will certainly supply the necessary information on all developmental stages of individual species that are still poorly known.

One troublesome aspect of working with the literature on the South American Odonata is the large number of short publications that must be consulted. Comprehensive reviews and long monographs, which were characteristic of the literature prior to the middle of the 20th century, have become rare. As a result, anyone wishing to rely on original descriptions will be forced to obtain large numbers of short papers published in a many different journals. While this book may alleviate this problem to some extent, taxonomists will still have to consult original publications in the future when modifying the systematics, making a good library service essential.

Most taxonomists who have been engaged in work on the dragonflies must be complimented on their conformity with conventions established among themselves. These include not describing new species based only on larvae, providing illustrations of the genitalia, describing more or less the same structures of related species, and basing descriptions on features given special attention by earlier authors. Because of this, problems are encountered less frequently when reviewing dragonfly publications than when working with the literature of many other insect groups.

In spite of the relatively good and reliable work done by taxonomists specializing in South American Odonata, synonyms are not rare. It is likely that

more will be found after the natural variability of the South American species has been elucidated.

As already discussed, there is considerable variability in the coloration of some species. Other species are much less variable in coloration, making the color pattern a reliable way of recognizing them. It is possible that the color cues given to potential mates of the same species are limited to certain distinctive markings, still known only to the dragonflies. The rest of the color pattern could therefore display considerable variability without reducing the chances of the individual to find a mate. The changes in the color pattern that occur after mating may also assist members of the same species to avoid unsuitable mates. Much more must be learned about this before the color pattern can be considered a fully reliable means of identifying certain South American species. However, when more is known about the role of coloration as a means of intraspecific recognition, it is likely that it will become possible to recognize most species in the field by their size and color alone.

Because many of the nominal species presently recognized by specialists have been described from only a few specimens, sometimes belonging to only one sex, improved knowledge of the group will almost surely reduce the number of recognized species in the future, possibly as much as the discovery of rare species from remote locations will increase it.

3.2.6. Suggestions for improvement

Field investigations should be encouraged throughout South America to provide descriptions of the larval instars and both male and female adults. To reliably characterize specific kinds of habitat according to the species present, it is usually necessary to be able to correctly identify all life stages of each species. For example, to facilitate faunal survey, larval specimens as well as adults must be identified to species. Therefore, preliminary taxonomic work will require the correct matching of identified adults with the corresponding larvae in the water. This may be done in several ways, the best of which is rearing in artificial habitats, as discussed in the previous sections.

Artificial habitats in the laboratory for rearing larvae to adulthood will have to be constructed to mimic conditions in the field. In this way, all stages can be described as they develop. Dragonflies inhabiting standing water are usually fairly easy to maintain in aquaria, but those that develop in streams may be difficult to raise unless rather complex circulation systems are built. Species that develop in bromelias and other unusual habitats will require special facilities.

To obtain descriptions of the final instar larvae, it is easier to collect the exuviae, which are usually left on emergent plants, pieces of wood that extend above the surface of the water, or objects along the shore. The exuviae are usually found dry and firmly clinging to the emergent objects. They must then be correctly matched with the adults found near the water body, and if only one

adult is observed emerging, it can serve to identify a whole series of similar exuviae found after the adults had departed. The disadvantage of relying on such field collections is that only the final instar larva can be examined.

Some teneral specimens look so much different from the fully formed adults that identification may be impossible. Even after the adult begins to fly, it will not have taken on its final appearance. As already mentioned, if it is collected together with its exuvia, it should be maintained alive for several days to permit an adequate description. Using one of the many new methods of photography or video to document emergences and color changes and to match the adults with their larvae is strongly encouraged. Such records reveal the actual colors of living specimens, major morphological characters, and behavior typical of the species without the need to collect large numbers of specimens.

If emerging adults cannot be found together with their exuviae, parallel collections of larvae and adults from individual water bodies is sometimes relied upon by taxonomists to correctly match individual larval forms with the corresponding adults. In a few cases, however, congeneric species might be confused, so such efforts must be made with great caution.

Descriptions of new dragonfly species or previously undescribed life stages of known species should be prepared in a way that can be readily understood by other scientists, especially those who have not specialized in the taxonomy of the group. The importance of good illustrations cannot be overemphasized, and several authors cited in the keys below have provided exemplary illustrated descriptions that make identification by non-specialists relatively easy.

It would be extremely useful to have descriptions of the final instar larvae and adults of both sexes of each South American species. However, the rules of scientific nomenclature do not demand this, and authors cannot be expected to provide such complete sets of descriptions each time a new species is described in the future. Nevertheless, a minimum standard for species descriptions should be imposed by the editors of journals, and a set of features that should be described for each life stage is proposed in the outline below.

One practice that should be strongly discouraged is the description of a new species based on a life stage that has not been described for all other species in the genus. For example, if five congeneric species have been described only from adult male specimens, the description of a sixth based only on larval specimens should not be permitted. In such a case, it is obviously not possible to rule out the possibility that the sixth "species" is already among those previously described. Whenever more than one specialist is working on the taxonomy of any particular group, they should establish conventions by mutual agreement to designate a definitive life stage and sex to be described any time a new species of a given genus or family is named. Fortunately, the problem of incomplete descriptions making it impossible to distinguish species without examination of the type specimens does not occur very often when working with the Anisoptera of South America.

The following elements should be included in any description of an adult:

1. The genitalia of the male should be illustrated in ventral and lateral view, and the vulvar lamina or scale of the female should be shown in ventral view. Structures modified for mating should also be included, especially the anal appendages of the male and prothorax of the female. An illustration of the anal appendages of the female is also very helpful. If specimens of both sexes are not available, the description should await the collection of additional specimens. If this is deemed impossible, then an adult of the sex most frequently designated as the holotype for congeneric species should be selected. In most cases, this will be the male. It is important to preclude the descriptions of conspecific males and females as two distinct species.
2. The vein pattern of both the fore and hind wing should be clearly illustrated, and if sexual dimorphism is strong, the wings of both males and females should be shown. Markings on the wings should be described, and any tint or clouding of the wing membrane should be recorded. Variability in the markings of conspecific specimens is also important to note.
3. The lengths of the head and abdomen, fore and hind wings, pterostigma, antenna, anal appendages, and other prominent structures should be provided along with the total length, measured from the midpoint of the anterior margin of the head to the apex of the longest anal appendage. If measured differently, the anterior and posterior limits should be stated. The pterostigma should be measured along the costal vein, which runs along the leading edge of the wing.
4. The color patterns of both sexes and of the larvae should be described in detail. If the specimens examined are teneral, senescent, or discolored due to preservation, this should be stated.
5. Detailed descriptions of the heads of both males and females should include the color pattern, distance between the compound eyes relative to the diameter of one compound eye, location and disposition of the ocelli, peculiarities of the mouthparts, presence of any processes or modified setae, and the antennae.
6. The legs, size and arrangement of their spines, and the tarsal claws of adults of both sexes and larvae should be described and illustrated. The description should include mention of the color pattern, prominent setae, distances between spines relative to the length of one spine, relative lengths of the segments, and any remarkable modifications, such as the development of robust hooks for burrowing into the sediment.
7. Every anatomical character introduced by earlier authors as identifying features for recognizing species in the respective genus or family should be described, and the couplet in an existing key that would be reached if a specimen were "keyed out" should be mentioned. In every case, the reader of the descriptions should know unambiguously how the new species differs from all of those that were previously described in its genus.

In addition, descriptions of the eggs would be useful. Observations of their preferred habitats and special behavior patterns, such as crepuscular habits or spawning on plants, should also be recorded. Dimensions should be provided as maxima and minima for the series of specimens. The range of each dimension is

important to someone trying to identify a specimen, while the average is of little value to someone who does not know the range.

A note on the figures

Most illustrations were drawn based on figures appearing with the original descriptions of the species or later review papers. In a few cases, they are based on figures prepared to justify taxonomic revisions or with descriptions of taxa later found to be synonyms of species already described. When using illustrations of specimens other than a holotype, there is a risk of perpetuating earlier published errors in identification. Original figures on which those in this book are based should be consulted as primary sources whenever they exist. Minor discrepancies between illustrations and specimens being examined will exist because individual variability of these insects can be considerable, and few taxonomists have worked with extensive numbers of specimens from South America to appreciate the degree of this variability.

It is a general characteristic of dragonflies that many wing veins, virtually always including the costal veins, are lined with tiny denticulations, spines, or setae. These are omitted from most of the figures, which are meant to display the arrangements of the veins and the color patterns. These and other structures that are omitted from the semi-diagrammatic illustrations should be ignored in making identifications unless they are specifically mentioned as diagnostic features in the keys. Similarly, minor differences between the numbers of cross veins and the positions of other veins in the specimen being examined and the illustration should be disregarded because such features have been shown to be quite variable. Some judgement must be used to distinguish important from minor features. For example, if a range of 8 to 11 cross veins is given in the key, and an individual being examined possesses 7, this would not indicate that the specimen must belong to another species. If, however, the specimen had 4 such cross veins, the likelihood that it belongs to another species would be great. Similarly, minor deviations from the reported size ranges can be disregarded, but large differences of more than 20% of the reported dimensions are significant enough to support a conclusion that the specimen probably belongs to a different species.

As in the case of most insect orders, the genitalia are the most definitive structures. After a specimen is tentatively identified based on wing veins, color, size, or other features in a key, the genitalia or secondary sexual structures, such as the anal appendages or structures on the prothorax, should be compared with the illustration provided. If no illustration is provided, the original species description should be consulted. Unfortunately, in some cases, there are neither good illustrations nor adequate descriptions of the genitalia, and it will be necessary to compare a specimen with type specimens designated in the original description to make a positive identification. In such cases, taxonomists are encouraged to undertake revisions of the group to which the species belongs.

3.2.7. Key to the families of Anisoptera in South America

Adults

Information for the key was provided by Carle and Louton (1994).

1. The triangle is more distant from the arculus in the fore-wing than in the hind wing; its long axis is oriented at a right angle to the costa (**Fig. 3.2.10**). The end hook on the labial palp is shorter than the ligula, and the compound eyes are in contact.2
- Triangles in the fore and hind wing are approximately equidistant from the arculus and are similarly shaped (**Fig. 3.2.11**).3

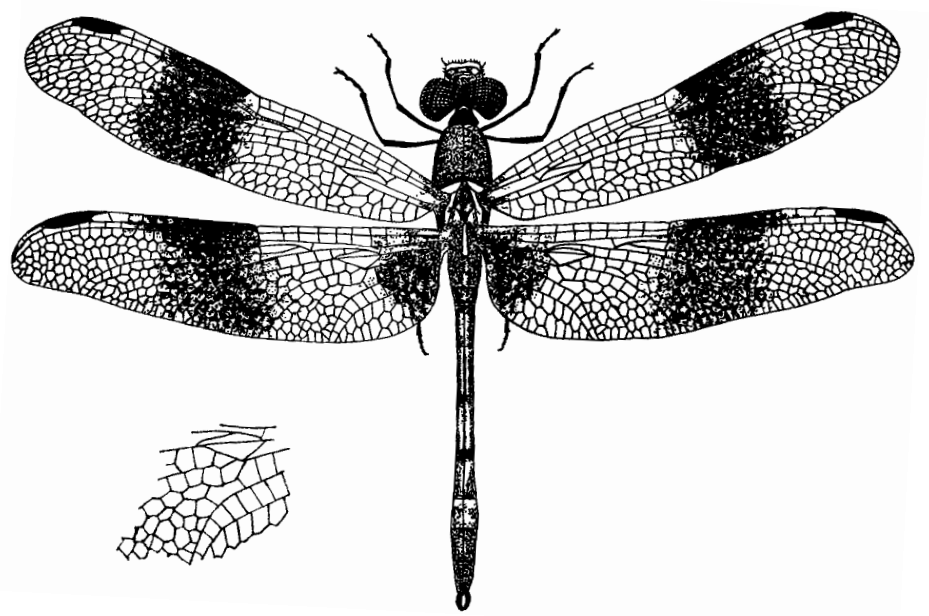


Fig. 3.2.10 Habitus of *Erythrodiplax venustus* with the veins in the area of the arculus, supratriangle, triangle, and anal loop in the left hind wing enlarged below left. Based on Kirby (1897).

2. The anal loop is much longer than wide but not boot-shaped; its distal angles appear similar, and its cells are divided into two rows. The posterior margin of the eye is emarginate. Males have auricles on the second abdominal segment, and the anal lobe of the hind wing is notched (**Fig. 3.2.12**).

.....Corduliidae..p. 56

This family was formerly designated as a subfamily of Libellulidae.

- The anal loop is much longer than wide and boot-shaped with the toe absent in a few species. Its distal angles usually appear similar, and its cells are usually divided into two rows. The posterior margin of the eye is evenly rounded. Males do not have auricles on the second abdominal segment, and the anal lobe of the hind wing is evenly rounded (**Fig. 3.2.10**).

.....Libellulidae..p. 93

3. The compound eyes meet or nearly meet on top of the head (**Fig. 3.2.11**).4

- The compound eyes are widely separated on top of the head (**Fig. 3.2.13**).6

4. The costal and subcostal spaces in the apical part of the wing are subequal in width, and the pterostigma is usually somewhat wider than the adjacent subcostal space. In the male, the internal posterior corner of the wing is not usually produced into a conspicuous lobe, and the anterior margin of the wing is not usually marked with a row of opaque spots (**Fig. 3.2.11**).

.....Aeshnidae..p. 382

- The costal space in the apical part of the wing and the pterostigma are much narrower than the subcostal space. The anal margin of the hind wing of the male is excavated, usually producing a lobe at the internal posterior corner. The wings have a row of opaque spots along their anterior margins (**Fig. 3.2.14**). The compound eyes are in contact only at a point.5

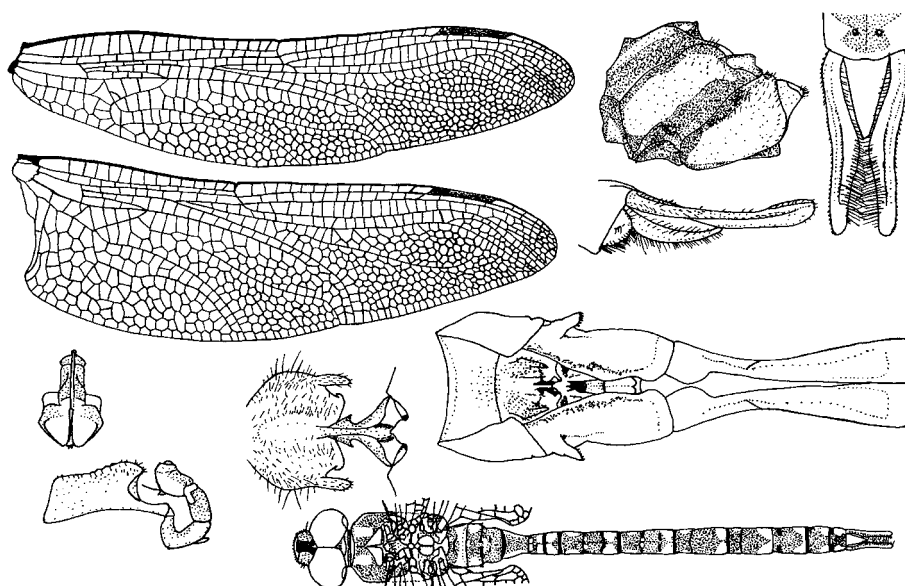


Fig. 3.2.11 *Remartinia restricta* male: fore and hind wing (upper left), color pattern on the lateral surface of the thorax (upper right center), genitalia on the second abdominal segment in ventral view (middle right) and the anterior lamina and hamular processes in ventral view (middle left center), penis in ventral (middle left) and lateral view (lower left), apex of the abdomen in dorsal (upper right) and lateral view (below thorax), and the color pattern on the dorsal surface of the body. Based on Carvalho (1992a).

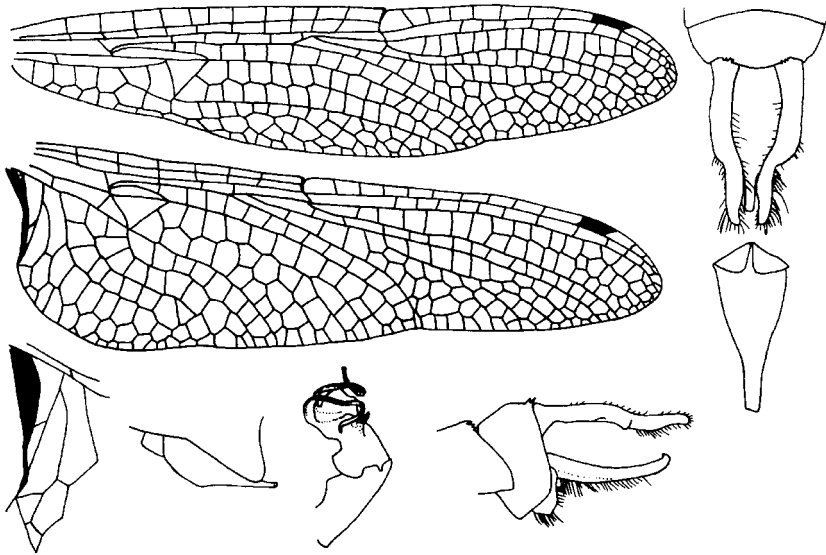


Fig. 3.2.12 *Navicordulia nitens* male: fore and hind wing (upper left), enlargement of the veins in the inner posterior corner of the hind wing (lower left), genital structures on the ventral side of the second abdominal segment in lateral view (lower left center), penis in lateral view (lower center), apex of the abdomen in dorsal (upper right) and lateral view (lower right center), and the inferior appendage in ventral view (lower right). Based on DeMarmels (1991a).

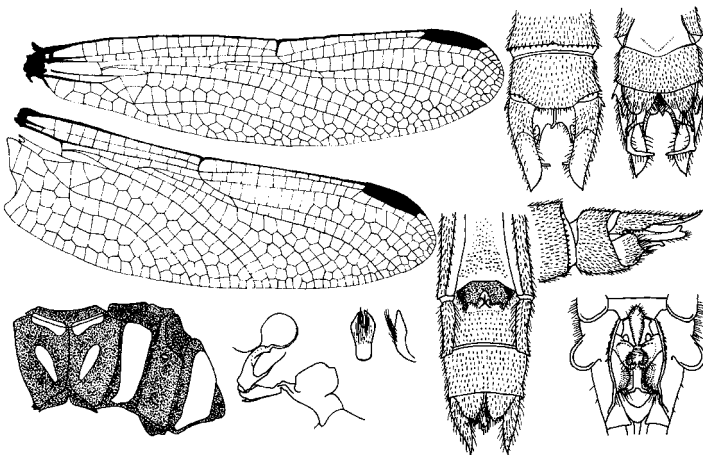


Fig. 3.2.13 *Progomphus guyanensis*: fore and hind wing of a male (upper left); lateral view of the male thorax showing the color pattern (lower left); apex of the male abdomen in dorsal (upper right center), ventral (upper right), and lateral view (middle right); male genitalia (lower right); penis enlarged (lower left center); apex of the female abdomen in ventral view (lower right center); the penis guard in anterior and lateral view (lower center, left and right, respectively). Based on Belle (1966a).

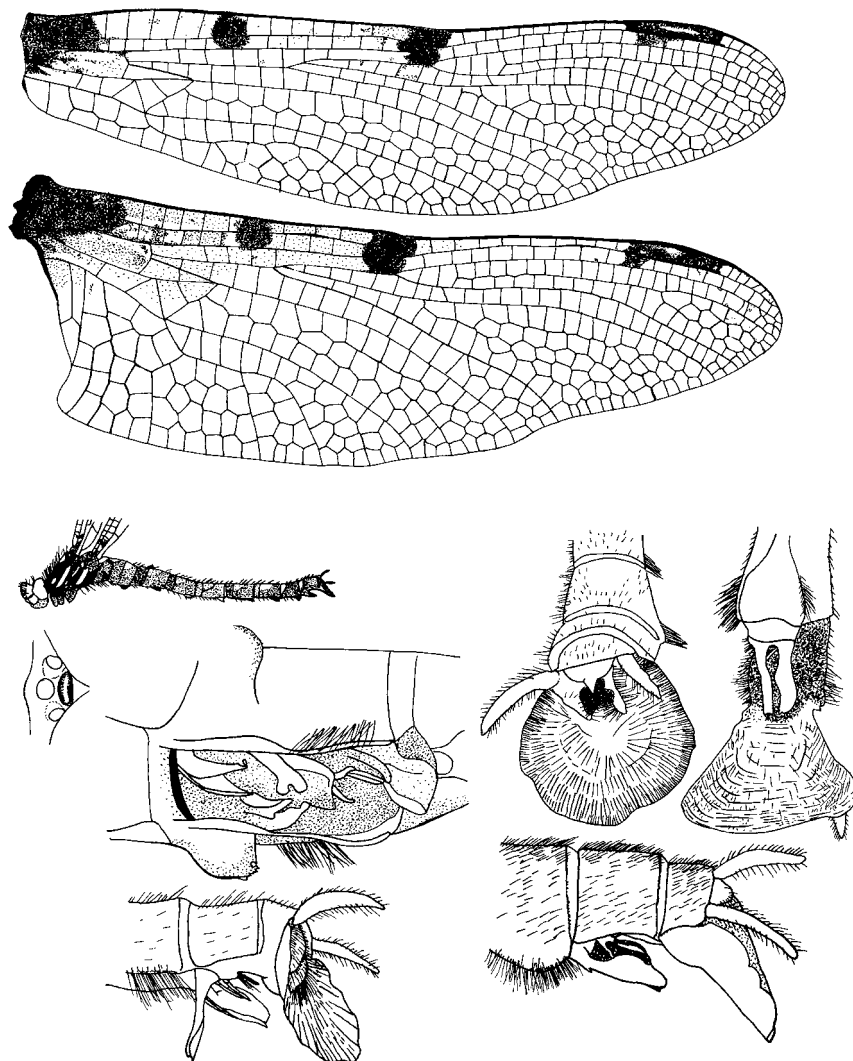


Fig. 3.2.14 *Neopetalia punctata*: fore and hind wing (above); and in the lower part of the figure: lateral view of the head, thorax and abdomen with only the wing bases and without the legs (upper left); vertex of the head of a male showing the ocellar triangle and callus (upper middle left); genitalia on the second abdominal segment of a male in ventrolateral view (left center); apex of the abdomen of a female in oblique posterodorsal (upper right center), oblique ventral (upper right), dorsolateral (lower right), and lateral view (lower left). Based on Schmidt (1941a).

5. There are only four dark spots along the costal margin of each wing, and there is no spot at the apex of the wing. At least the middle spots are reddish brown. The tenth segment of the female abdomen may be widely dilated and have an excavated ventral plate (**Fig. 3.2.14**).

.....Neopetaliidae

After recent revisions, the only known South American species remaining in this family is *Neopetalia punctata* (Hagen in Selys, 1854) from Argentina and Chile. Syn: *Petalia punctata* Hagen in Selys, 1854.

- There are more than four dark spots along the costal margin of each wing, and one of them is at the apex of the wing. The tenth segment of the female abdomen is narrow without any sign of dilation (**Fig. 3.2.15**).

.....Austropetaliidae..p. 375

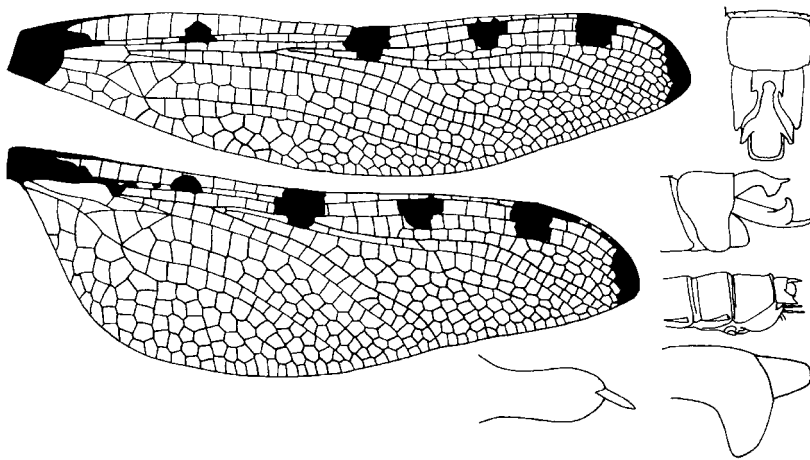


Fig. 3.2.15 *Phyllopetalia apollo*: fore and hind wing of a female (left), apex of the male abdomen in dorsal (upper right) and lateral view (upper middle right), apex of the female abdomen in lateral view (lower middle right), and the apex of the superior anal appendage of the male in dorsolateral (lower right center) and dorsomedial view (lower right). Based on Fraser (1933) and Dunkle (1985).

6. The pterostigma is linear, not widened medially. There is a strong lateral spine on each side of the thorax. The occiput bears three small posterior horns. The inferior anal appendage is very narrow and strongly sinuous in lateral view. The superior anal appendage is L-shaped (**Fig. 3.2.16**)

.....Petaluridae

Only one species in this family is known from South America: *Phenes raptor* Rambur, 1842, known only from Chile. Two subspecies have been described: *Phenes raptor raptor* Rambur, 1842; and *Phenes raptor centralis* Jurzitza, 1989.

- The pterostigma is rhomboid, wider toward the middle (**Fig. 3.2.13**).

.....Gomphidae..p. 511

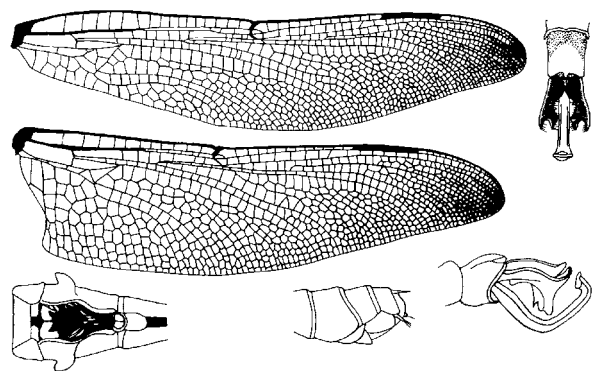


Fig. 3.2.16 *Phenes raptor*: fore and hind wing (upper left), male genitalia on the second abdominal segment (lower left), apex of the male abdomen in dorsal (upper right) and lateral view (lower right), and apex of the female abdomen in lateral view. Based on Fraser (1933).

Larvae

Information for the key was provided by Schmidt (1941a), Carle and Louton (1994), and Carvalho and Calil (2000).

- 1. The labium is flat and lacks dorsal premental setae; the labial palps, when retracted, do not cover the labrum and clypeus (**Fig. 3.2.17**).2
 - The labium appears rounded and hollowed out, and the labial palps, when retracted, cover the labrum and clypeus (**Fig. 3.2.18**).6
- 2. The antenna consists of three or four segments, the third of which accounts for more than half the length of the antenna. The second segment of the mandible is movable. The prementum is flat nor nearly so, and the ligula is not cleft (**Fig. 3.2.19**). There are two tarsal segments on the middle legs. There are transverse muscles and anterolateral sternal apodemes on the fifth and sixth and sometimes also the fourth abdominal segments. The sclerotized proventricular lobes are elongated and bear a rasp of 8 to 20 scattered teeth.
.....Gomphidae..p. 511
 - The antennae are not notably thickened and consist of six or more segments. All tarsi consist of three segments (**Fig. 3.2.17**).3
- 3. The segments of the antenna are thread-like. There are no dorsolateral tufts of setae on the abdominal segments, and no dorsolateral spur at the base of the hook on the palpal lobe. In most species, the inferior anal appendage has two sharp points at the apex (**Fig. 3.2.17**).
.....Aeshnidae..p. 382

- At least one of the two basal segments of the antenna is somewhat thickened, or the apical antennal segments are less than twice as long as wide. The known larvae have dorsolateral tufts of setae on the abdominal segments, or they bear patches of scales (Fig. 3.2.20).4

4. The two basal segments of the antenna are somewhat thickened, while the apical segments are long and narrow. The head, thorax, abdomen, and legs are rather thickly coated with scales. The labium is almost twice as long as wide or longer. The inner part of the labial palp forms a single elongate process. The lateral margins of the abdominal segments are flattened and form fin-like extensions (Fig. 3.2.21).Austropetaliidae..p. 375

- The segments of the antenna are short; the length of each of the three apical segments is less than twice the width. There are dorsolateral tufts of hair-like setae on the abdominal segments. Lateral extensions of the abdominal segments are not developed into fin-like extensions (Fig. 3.2.20).5

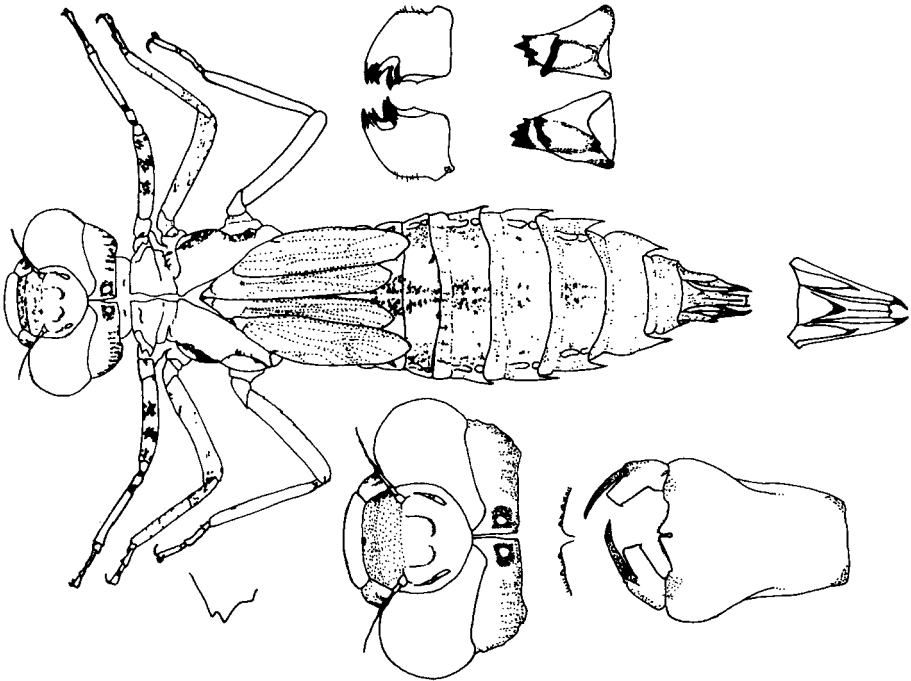


Fig. 3.2.17 *Rhionaecshna confusa* larva: habitus (middle); outline of the left lateral margin of the prothorax (lower left); head in dorsal view (lower center); labium in dorsal view with an enlarged outline of the anterior margin of the prementum to its left (lower right); the apex of the male larval abdomen in dorsal view enlarged (middle right); the left and right mandibles in posterior (upper left center) and inner views (upper right center). Based on von Ellenrieder (2001b).

5. The inner margin of the labial palps is straight and not armed with irregular lobes. The labium is about as long as wide, sometimes slightly longer. There are burrowing hooks at the apices of the tibiae. The caudal appendages form a vent directed dorsally. The epiproct is smooth at the apex and lacks two sharp points. The sides of the prementum are subparallel for the apical 60% of their length; the prementum narrows abruptly near the basal hinge. There is a strong dorsolateral spur at the base of the end hook on each labial palp (**Fig. 3.2.20**). The molar lobe bears teeth. The muscles on the fourth and fifth abdominal segment are vestigial. There are eight sclerotized lobes on the proventriculus, sometimes bearing as many as six uniform, blunt teeth. The larva can reach at least 46 mm.

.....Petaluridae

Only one species in this family is known from South America: *Phenes raptor* Rambur, 1842, known only from Chile. Two subspecies have been described: *Phenes raptor raptor* Rambur, 1842; and *Phenes raptor centralis* Jurzitza, 1989.

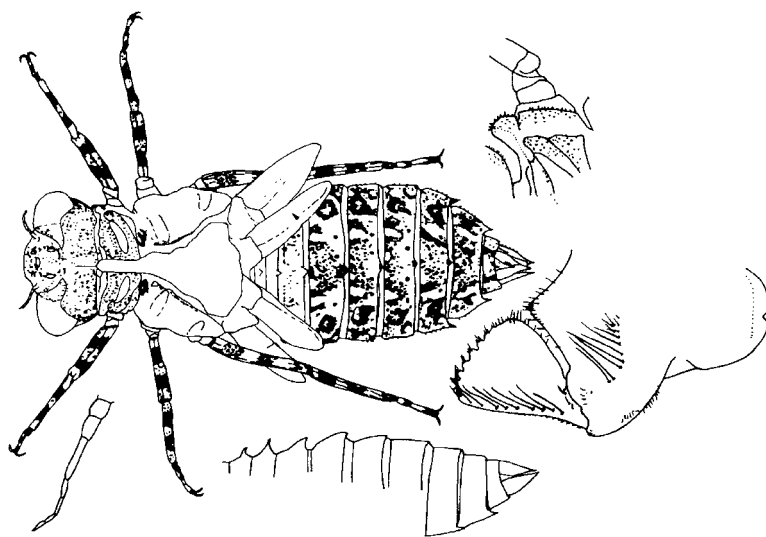


Fig. 3.2.18 *Brechmorhoga vivax* larva: habitus from exuvia (upper left); antenna (lower left); lateral profile of the abdomen (lower center); lateral projection of the prothorax with the coxa, trochanter, and base of the femur in dorsal view (upper right); part of the labium with one labial palp (lower right). Based on DeMarmels (1982a).

- The labial palps form two lobes and bear five or six irregular, elongate medial teeth. There are glossal and paraglossal lobes on the ligula. There are four to six vestigial setae on the prementum and one short dorsomedial seta on the labial palp near the base of the apical hook. The antenna consists of six segments, the

third of which is more than twice as long as the second. The antefrons forms a mound-like protuberance. The wing pads are oriented parallel to each other. The tubercle on the epiproct of the male is sharply pointed. There are no paracoxal lobes on the mesosternum. The medial sulcus on the metasternum is joined by transverse sulci. The sixth abdominal sternite lacks anterolateral apodemes. The vulvar lamina is about $\frac{1}{3}$ as long as the ninth sternite (**Fig. 3.2.22**).

.....Neopetaliidae

After recent revisions, the only known South American species remaining in this family is *Neopetalia punctata* (Hagen in Selys, 1854) from Argentina and Chile. Syn: *Petalia punctata* Hagen in Selys, 1854.

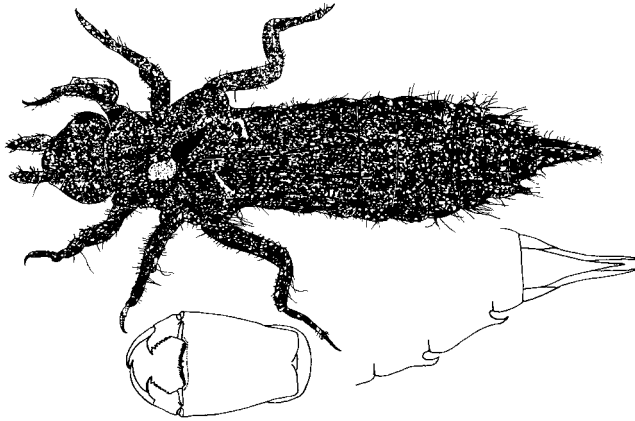


Fig. 3.2.19 *Zonophora campanulata machadoi* larva: habitus from an exuvia (above), labium in ventral view (lower left), left side of the apical segments of the abdomen in dorsal view, not showing the hair-like setae (lower right). Based on Belle (1992a).

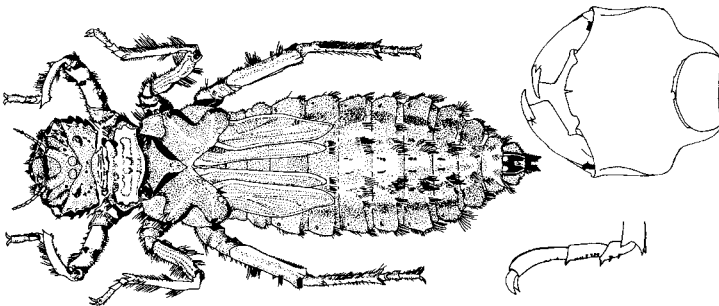


Fig. 3.2.20 *Phenes raptor* larva: habitus (left), labium (upper right), and apex of the hind tibia and tarsi (lower right). Based on Needham and Bullock (1943).

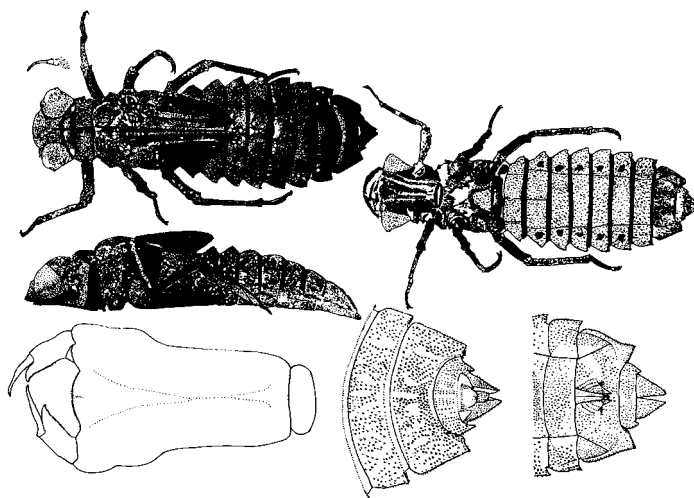


Fig. 3.2.21 *Hypopetalia pestilens* larva: habitus in dorsal (upper left), ventral (upper right), and lateral view (middle left), antenna (upper left corner), labium (lower left), apex of the male abdomen in dorsal view (lower center), and apex of the female abdomen in ventral view (lower right). Based on Schmidt (1941a).

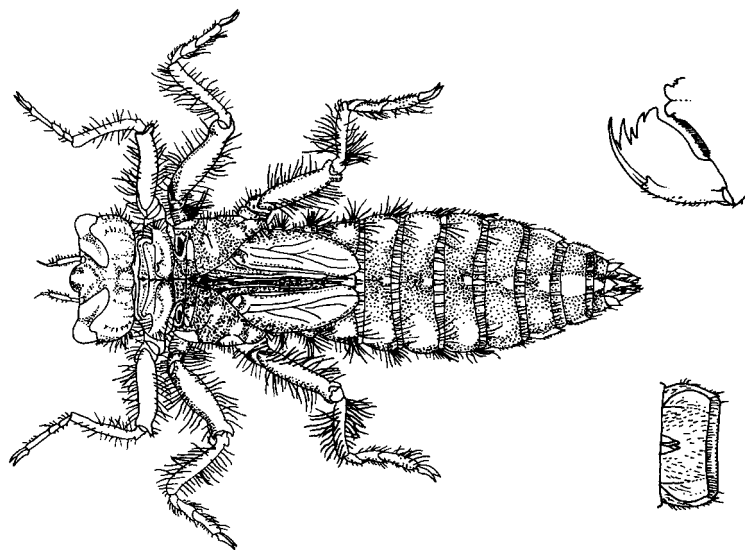


Fig. 3.2.22 *Neopetalia punctata* larva: habitus (left), labial palp and part of prementum (upper right), and the ninth abdominal segment of a female larva in ventral view (lower right). Based on Carle and Louton (1994).

6. There is no distinct crest separating the dorsal and anterior surfaces of the head. The setae on the head are fine and cylindrical (**Fig. 3.2.18**).

.....Libellulidae..p. 93

- There is a distinct frontal crest with its margin covered by short setae separating the dorsal and anterior surfaces of the head. Flattened clavate setae are present on the head, including its frontal crest (**Fig. 3.2.23**).

.....Corduliidae..p. 56

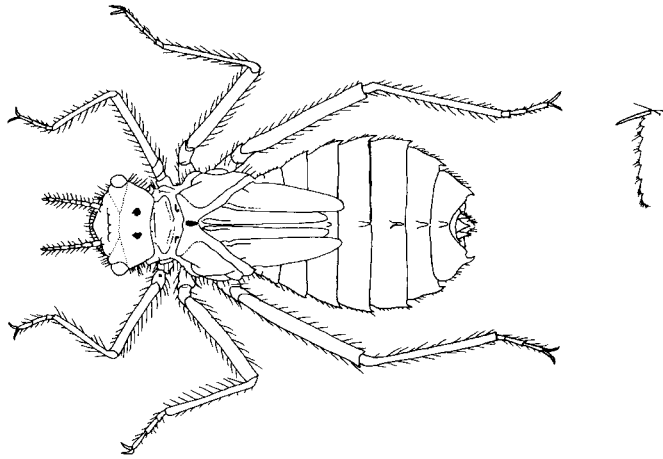


Fig. 3.2.23 *Rialla villosa* larva: habitus (left) and the apex of the lateral lobe of the labium (right). Based on Needham and Bullock (1943).

Corduliidae

Key to the genera of adults in South America

The information for the key was provided by Geijskes (1970), Costa and Santos (1992), and Carvalho *et al.* (2004).

1. In the hind wing, the triangle is slightly distal to the arculus, the sectors of which are connected at the origin for some distance. There is more than one cell between the distal end of the anal loop and the hind margin of the wing (**Fig. 3.2.24**). The triangles and subtriangles are free.

.....Subfamily Gomphomacromiinae.2

- The triangle in the hind wing is situated at the arculus or just proximal to it. Usually one cell separates the anal loop from the hind margin of the wing (**Fig. 3.2.25**). The triangles in the fore-wing are sometimes crossed. The subtriangles are divided into two or three cells.

.....Subfamily Corduliinae.4

2. The discoidal cell of the fore-wing has two rows of cells throughout. Cells M_3 and M_4 are parallel-sided or only slightly divergent at the wing margin. The anal loop is elongated and sometimes truncate at the apical end but reaching the level of the middle fork of M or beyond. The bisector is distinct. There are three or four rows of cells in the anal area of the hind wing (**Fig. 3.2.24**). The male inferior anal appendage is oval to triangular with the apex truncate and often bifid.

.....*Neocordulia* Selys, 1882..p. 65
 - In the fore-wing, the proximal part of the discoidal cell has one row of cells, widening to three or four cell rows distally. The anal loop is abbreviated or hardly reaches beyond the triangle. The bisector is indistinct. There are two or rarely three rows of cells in the anal area of the hind wing (**Fig. 3.2.26**).3

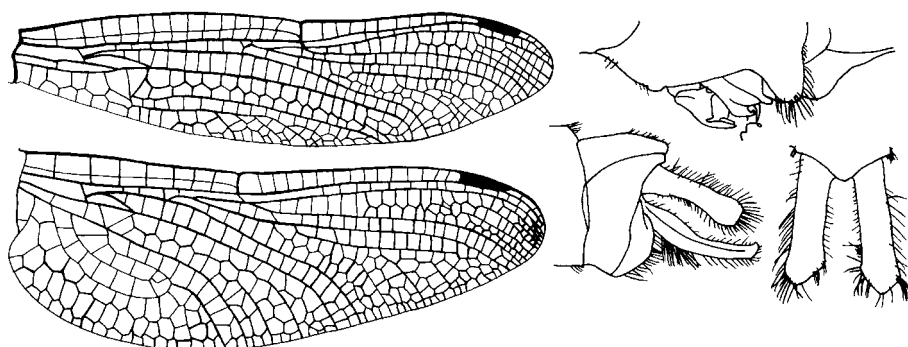


Fig. 3.2.24 *Neocordulia batesi longipollux* male: fore and hind wing (left), genitalia on the second abdominal segment in lateral view (upper right), apex of the abdomen in lateral view (lower right center), and superior anal appendages in dorsal view (lower right). Based on Calvert (1909a).

3. The male inferior anal appendage is quadrangular. The seventh abdominal segment widens apically, roughly doubling its width at the apical border. The eighth segment has parallel sides which maintain a constant width about equal to the maximum width of the seventh segment. The ninth and tenth segments narrow gradually apically. The “identification mark,” large light colored spots near the apex of the abdomen, are on the eighth segment rather than the seventh, as in other anisopterans with such markings. There is no mid-dorsal spine on the tenth abdominal segment. The vulvar scale on the eighth segment of the female is very long and forms two lobes extending beyond the end of the abdomen (**Fig. 3.2.26**).

.....*Gomphomacromia* Brauer, 1864..p. 75

- The male has a small conical protuberance on the eighth abdominal segment, a triangular inferior anal appendage, and a very robust, conical middorsal spine on the tenth abdominal segment. The ventral plate on the eighth segment of the female reaches only to the distal margin of the segment (**Fig. 3.2.27**).

.....*Lauromacromia* Geijskes, 1970..p. 78

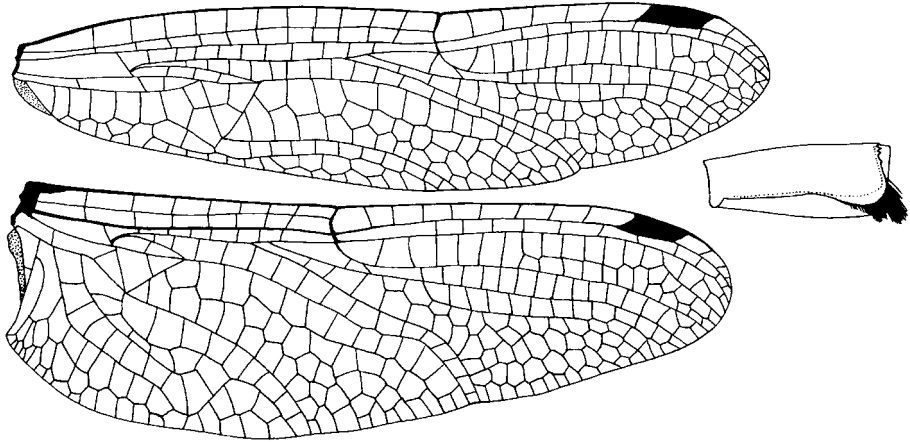


Fig. 3.2.25 *Aeschnosoma rustica* male: fore and hind wing (left), seventh abdominal segment in ventrolateral view (right). Based on Geijskes (1970).

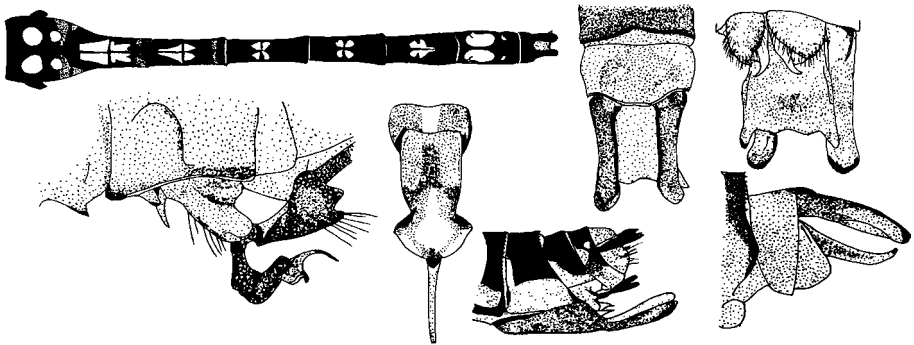


Fig. 3.2.26 *Gomphomacromia nodisticta*: color pattern on the abdomen of a male in dorsal view (upper left); male genitalia on the second abdominal segment (lower left); penis in dorsal view (lower left center); apex of the male abdomen in dorsal (upper right center), ventral (upper right), and lateral view (lower right); apex of the female abdomen in lateral view (lower right center). Based on von Ellenrieder (2000b).

4. Supratrangular cross veins are present. All triangles and subtriangles are divided into two or three cells. There are two or more cubital cross veins in both wings. M_3 and M_4 are undulate. The nodus is in the distal half of the wing. The fore-wing has 11 to 20 antenodal and 5 to 11 postnodal cross veins; the hind wing has 7 to 14 and 8 to 14 such veins, respectively (**Fig. 3.2.25**).

.....*Aeschnosoma* Selys, 1871..p. 80
 - Supratrangular cross veins are usually absent. There is one cubital cross vein in the fore-wing and one or two in the hind wing. M_3 and M_4 are not undulate (**Fig. 3.2.28**).5

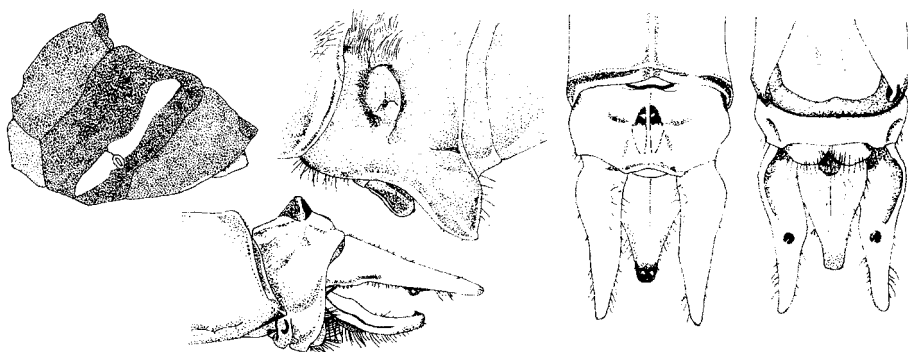


Fig. 3.2.27 *Lauromacromia flaviae* male (upper row, left to right): color pattern on the lateral surface of the thorax, male genitalia and auricles on the second abdominal segment in lateral view, and the apex of the abdomen of a male in dorsal and ventral view, and (below) a lateral view of the apex of the male abdomen. Based on Machado (2002a).

5. The triangle in both the fore and hind wing are crossed. The sectors of the arculus are separated at the origin of both wings. The discoidal cell in the fore-wing is parallel-sided or only slightly narrowed distally, with two rows of cells in the proximal part and three rows in the distal part. The nodus is located at the mid-length of the fore-wing. Seven to nine antenodal cross veins are present in the fore-wing, and there are five or six in the hind wing. There is one cubital cross vein in the fore-wing and one or two in the hind wing. The anal loop is elongate and slightly truncated at the apical end with two cells in the first row. Three rows of cells are present in the anal area. The membranule is long and dark. The vulvar sac of the female is large and triangular and split at its apex for half of its length (**Fig. 3.2.29**).

.....*Rialla* Navás, 1915
 There is only one species, *Rialla villosa* (Rambur, 1842), known only from Chile and Argentina, also known by synonyms: *Cordulia villosa* Rambur, 1842; *Anticordulia villosa* (Rambur, 1842).

- The triangle of the hind wing is free. There are usually two rows of cells in the discoidal field of the fore-wing, but occasionally one or three may be present for part of its length. In both wings, there is only one cubital cross vein. The anal loop is elongate and slightly truncated or sac-like at its distal end; the heel is usually at the level of the middle fork of M. There are two or three rows of cells in the anal area. The membranule is not very long (**Fig. 3.2.30**).6

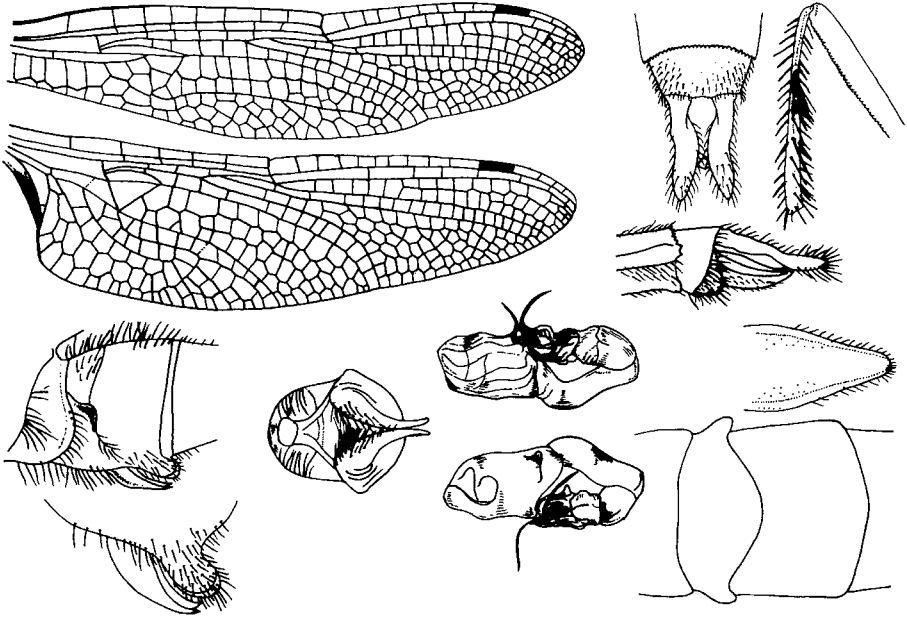


Fig. 3.2.28 *Santosia marshalli* male: fore and hind wing (upper left), first two abdominal segments of a male (middle left) with an enlargement of the hamules in lateral (lower left) and ventral view (lower left center); apex of the abdomen in dorsal (upper right center) and lateral view (upper middle right); enlargement of the inferior anal appendage in ventral view (lower middle right); apex of the middle femur and the tibia (upper right); two lateral views of the penis (lower right center); auricles (lower right). Based on Costa and Santos (1992).

6. The female has a long ovipositor. The triangles in the hind wing are free, and those in the fore-wing are only very rarely crossed. The sectors of the arcus in the hind wing are not connected at the origin. There are 2 cells in the first row of the anal loop, and 2 or 3 rows of cells in the anal area of the hind wing. The superior anal appendages of the male are no more than slightly longer than the ninth and tenth abdominal segments. They are subcylindrical with blunt or pointed apices. The inferior anal appendage is triangular with a rounded apex and not as long as the superior appendage, but sometimes almost as long. The vulvar scale of the female is prolonged, but it reaches no more than to the

middle of the ninth abdominal segment; it is rounded and excavated in the middle (**Fig. 3.2.30**).

.....*Navicordulia* Machado and Costa, 1995..p. 85

Prior to the publication by Machado and Costa (1995), the species in this genus had been referred to the North American genus, *Dorocordulia* Needham, 1901, the females of which, however, do not have long ovipositors.

- The ovipositor is not very long (**Fig. 3.2.31**). The triangle in the fore-wing is crossed, and that in the hind wing is free.7

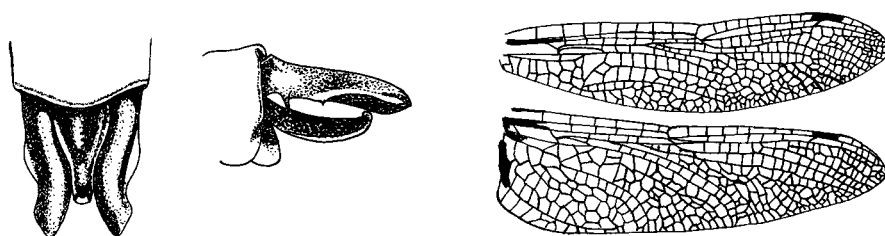


Fig. 3.2.29 *Rialla villosa* (left to right): apex of the male abdomen in dorsal and lateral view and the fore and hind wing (right). Based on Fraser (1939) and Böttger and Jurzitza (1967).

7. In the hind wing, the sectors of the arcus remain connected for some distance from the common base. The nodus in the fore-wing is located at a point $3/5$ of the length from the base. The fore-wing has 10 or 11 antenodal cross veins, and the hind wing has 6 or 7. The anal loop has three cells in the first row and is slightly truncated. There are two rows of cells in the anal area of the hind wing. The superior anal appendages of the male are much longer than the inferior and are bluntly rounded and curved inward at the apex. The vulvar scale of the female extends to the middle of the ninth abdominal segment and is triangular with a rounded apex (**Fig. 3.2.31**).

.....*Paracordulia* Martin, 1907

The only known species in this genus, *Paracordulia sericea* (Selys, 1871), has been found in French Guiana, Surinam, Venezuela, and Pará.

- The sectors of the arcus in both the fore and hind wing are separated at the origin. The nodus of the fore-wing is located at a point $2/3$ of the way from the base. There are eight antenodal cross veins in the fore-wing. The apical end of the anal loop is not truncate. The superior anal appendage of the male is longer than the inferior by $1/4$ of its length; it diverges apically (**Fig. 3.2.28**).

.....*Santosia* Costa and Santos, 1992..p. 90

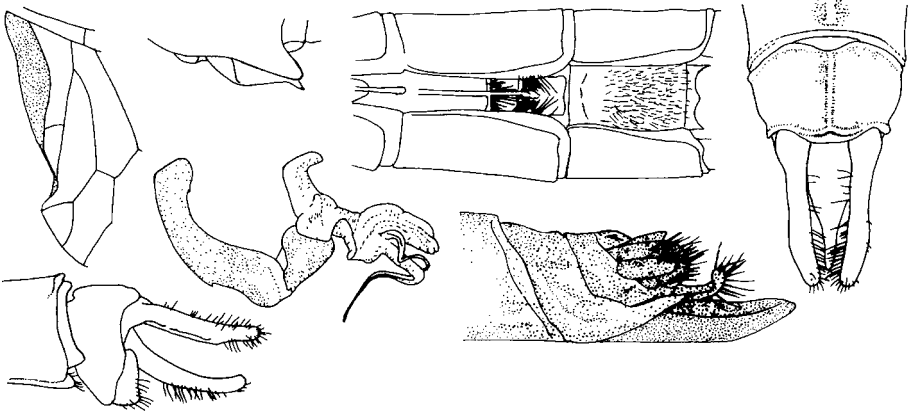


Fig. 3.2.30 *Navicordulia errans* (above, left to right): anal triangle and membranule on the hind wing, genitalia on the second abdominal segment in lateral view (upper center), ventral view of the seventh and eighth abdominal segments of a male showing the pilose complex and pilose area, apex of the abdomen in dorsal view, and (below, left to right) lateral views of the apex of the male abdomen, penis, and apex of the female abdomen. Based on Machado and Costa (1995).

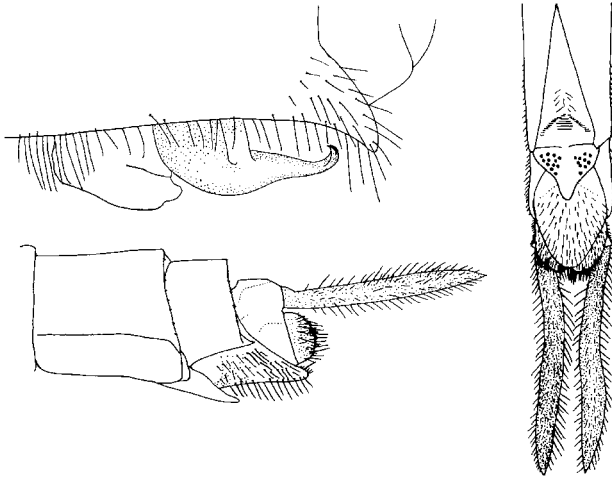


Fig. 3.2.31 *Paracordulia sericea*: male genitalia on the second abdominal segment in lateral view (upper left) and the apex of the female abdomen in ventral (right) and lateral view (lower left). Based on Geijskes (1970).

Key to the genera of known larvae of Corduliidae in South America

The information for the key is from Costa and Santos (2000a). Larvae of *Gomphomacromia*, *Lauiromacromia*, and *Paracordulia* remain undescribed.

1. There are mid-dorsal hooks on the abdominal segments (**Fig. 3.2.23** and **3.2.32**).2
 - There are no dorsal hooks on the abdomen (**Fig. 3.2.32**).3
2. Dorsal hooks are present only on the sixth through ninth abdominal segments. The eighth and ninth abdominal segments bear lateral spines. There are 10 to 11 mental setae on each side of the labium (**Fig. 3.2.32**).
*Navicordulia* Machado and Costa, 1995..p. 65
 - Dorsal hooks are present on the third through ninth abdominal segments. The fifth through ninth abdominal segments bear lateral spines. There are 7 mental setae on each side of the labium (**Fig. 3.2.23**).
*Rialla* Navás, 1915
- There is only one species, *Rialla villosa* (Rambur, 1842), known only from Chile and Argentina, also known by the synonyms: *Cordulia villosa* Rambur, 1842; *Anticordulia villosa* (Rambur, 1842).
3. Lateral spines on the ninth abdominal segments are longer than the combined lengths of the ninth and tenth segments along the midline (**Fig. 3.2.33**).
*Aeschnosoma* Selys, 1871..p. 80
 - Lateral spines on the ninth abdominal segment are shorter than the combined lengths of the ninth and tenth segments along the midline (**Fig. 3.2.34**).4

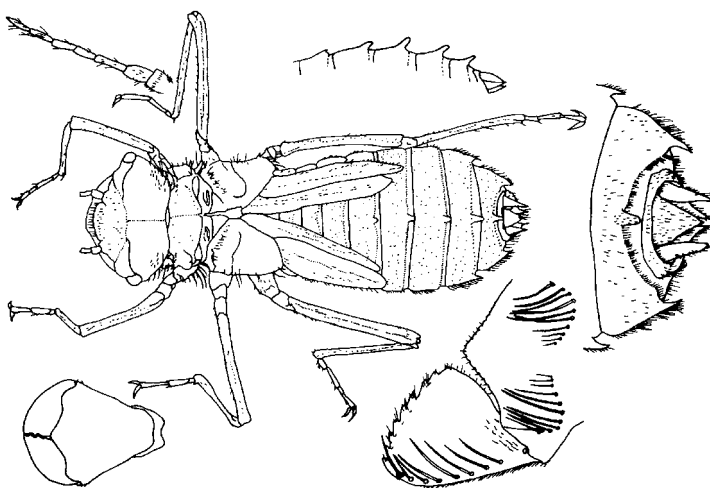


Fig. 3.2.32 *Navicordulia nitens* larva: habitus (middle), antenna enlarged (upper left), mentum in ventral view (lower right), dorsal profile of abdomen (upper center), anterior part of mentum and palp in dorsal view (lower right), and dorsal view of the apex of the abdomen (right). Based on DeMarmels (1991a).

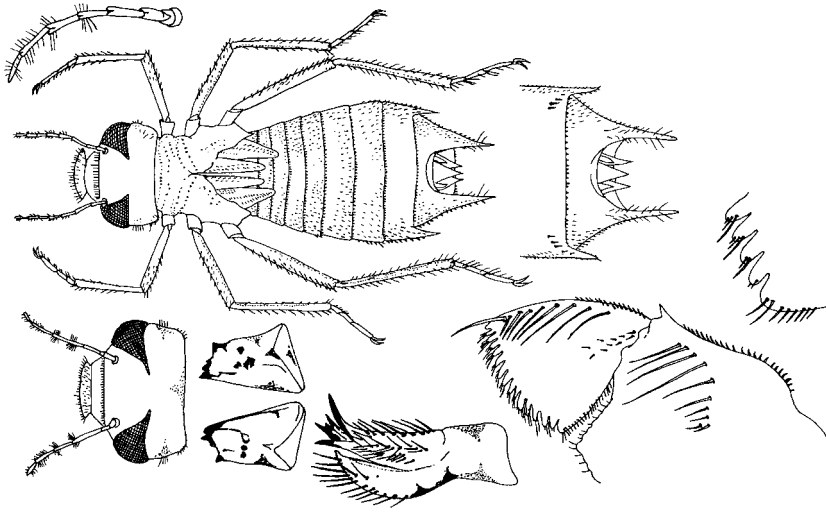


Fig. 3.2.33 *Aeschnosoma marizae* larva: habitus with an enlarged antenna above it and an enlarged dorsal view of the head below it (left), spines and caudal appendages enlarged (upper right center), half of the labium (lower right), a portion of the margin of the labial palp (middle right), maxilla (lower center), and mandibles (lower left center). Based on Costa and Santos (2000a).

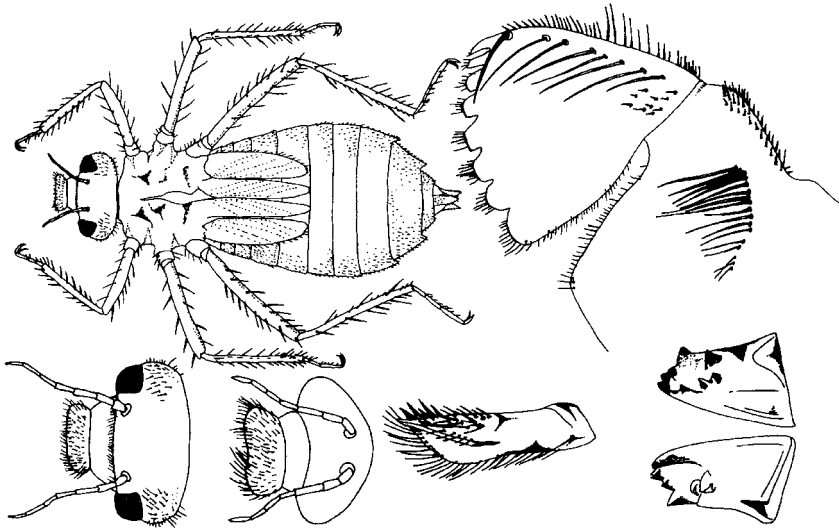


Fig. 3.2.34 *Santosia machadoi* larva: habitus with an enlarged dorsal view of the head below it (left), labrum (lower left center), half of the labium (upper right), maxilla (lower right center), and mandibles (lower right). Based on Costa and Santos (2000a).

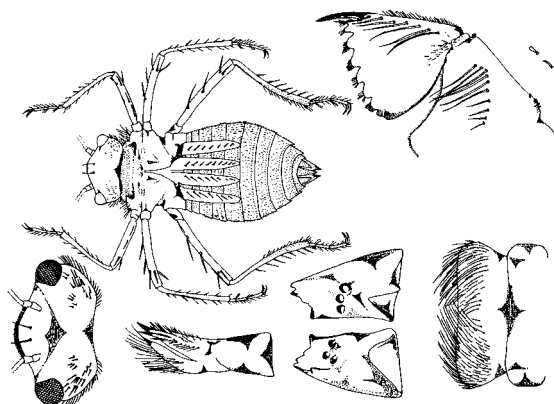


Fig. 3.2.35 *Neocordulia setifera* larva: habitus of exuvia (upper left), enlarged dorsal view of the head (lower left), labrum (lower right), half of the labium with enlargements of two kinds of seta found on it above and to the right (upper right), maxilla (lower left center), and mandibles (lower right center). Based on Costa and Santos (2000a).

4. The antenna, when extended over the anterior part of the head, reaches the lateral lobes (**Fig. 3.2.34**).

.....*Santosia* Costa and Santos, 1992..p. 90

- The antenna, when extended over the anterior part of the head, does not reach the lateral lobes (**Fig. 3.2.35**).

.....*Neocordulia* Selys, 1882..p. 65

Key to the species of adult *Neocordulia* in South America

Information for the key was provided by Calvert (1909a), May (1991), Costa and Santos (2000b), and Machado (2005a).

1. The eighth abdominal segment of the male lacks a conical or biconical process on the ventral surface. The superior anal appendage of the male lacks distinct teeth or angulations (**Fig. 3.2.36**). The hind femur of the male is not longer than 6.8 mm, and that of the female is not longer than 6.9 mm and is lined with small denticles for its whole length along an anterolateral ridge on the flexor surface. The length of the tenth abdominal segment of the female measured along the ventrolateral edge is about twice as long as its middorsal length.2

- The eighth abdominal segment of the male has a conical or biconical process on the ventral surface. Each superior anal appendage of the male bears a distinct ventrobasal tooth and sometimes other teeth or angulations (**Fig. 3.2.37**). The hind femora of both males and females are at least 7.2 mm long, and that of the

female is lined with small denticles for 1/3 to 1/2 of its length along an anterolateral ridge on the flexor surface. The length of the tenth abdominal segment of the female measured along the ventrolateral edge is about half again as long as its middorsal length.3

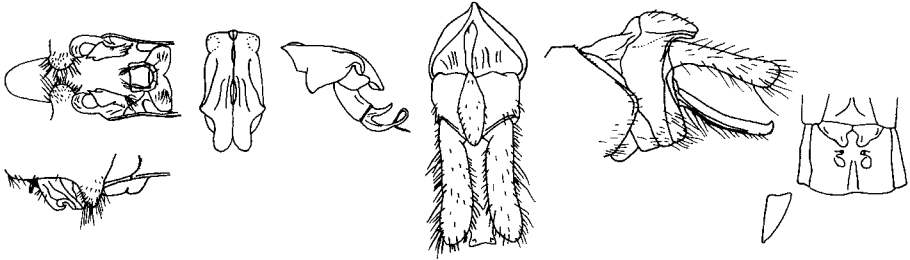


Fig. 3.2.36 *Neocordulia griphus* (left to right): male genitalia on the second abdominal segment in ventral (above) and lateral view (below), apex of the penis in ventral view with the median lobe absent, penis with penis guard in lateral view, apex of the male abdomen in dorsal and lateral view, outline of female superior anal appendage in dorsal view (below), and vulvar lamina on the ninth abdominal segment of a female in ventral view. Based on May (1991).

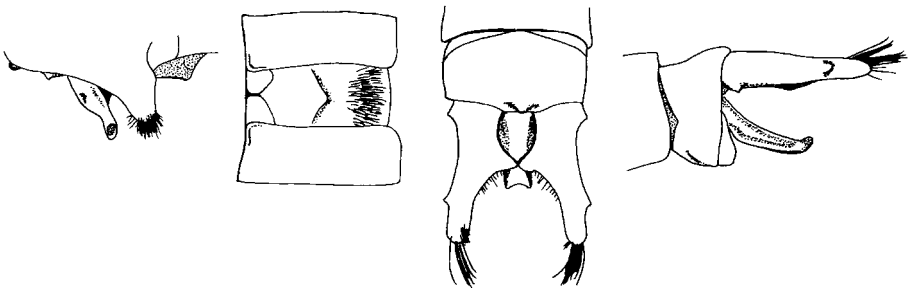


Fig. 3.2.37 *Neocordulia matutuensis*, male (left to right): genitalia on the second abdominal segment in lateral view, ventral view of the ninth abdominal segment showing the conical process and pilose region, and the apex of the abdomen in dorsal and lateral view. Based on Machado (2005a).

2. The diameter of the superior anal appendage of the male remains the same for most of its length but usually has a subapical expansion; its length is less than 2.3 mm. The hamules of the male are not robust, and the lateral ridges of its dorsal and ventral branches are narrow (**Fig. 3.2.24**). The lobes of the vulvar lamina on the ventral side of the ninth abdominal segment of the female have their apicomedial corners extended to truncate or subacute apices directed

posteriad. Dimensions of South American subspecies: total length, 43 to 48.5 mm; abdomen length, 31 to 35.5 mm; hind wing length, 31.5 to 34 mm.

.....*Neocordulia batesi* (Selys, 1871)
(Mexico to São Paulo). Syn: *Gomphomacromia batesi* Selys, 1871. Two subspecies are recognized and sometimes treated as distinct species: *Neocordulia batesi batesi* (Selys, 1871) inhabits Colombia, Ecuador, and Peru and has been reported from São Paulo and the larger *Neocordulia batesi longipollex* Calvert, 1909, known only from Mexico to Panama.

- In dorsal view, the width of the superior anal appendage of the male gradually increases for most of its length, reaching a maximum just before the apex; it is longer than 2.5 mm. The hind femur is at least 6.4 mm long. The hind wing of the male is at least 36 mm long, and that of the female, at least 40 mm. The hamules of the male are robust, and the lateral ridges of its dorsal and ventral branches are thick (**Fig. 3.2.36**). The lobes of the vulvar lamina on the ventral side of the ninth abdominal segment of the female have their apicomedial corners rounded at the apices and directed posteromedially. Length of male: 54 mm; female: 45 mm. Abdomen length of male: 39 to 42.5 mm. Hind wing length of male: 36.5 to 38 mm.

.....*Neocordulia griphus* May, 1991
(Central America).

3. Males, with genitalia on the ventral side of the second abdominal segment (**Fig. 3.2.3**).4

- Females, without genitalia on the second abdominal segment.10

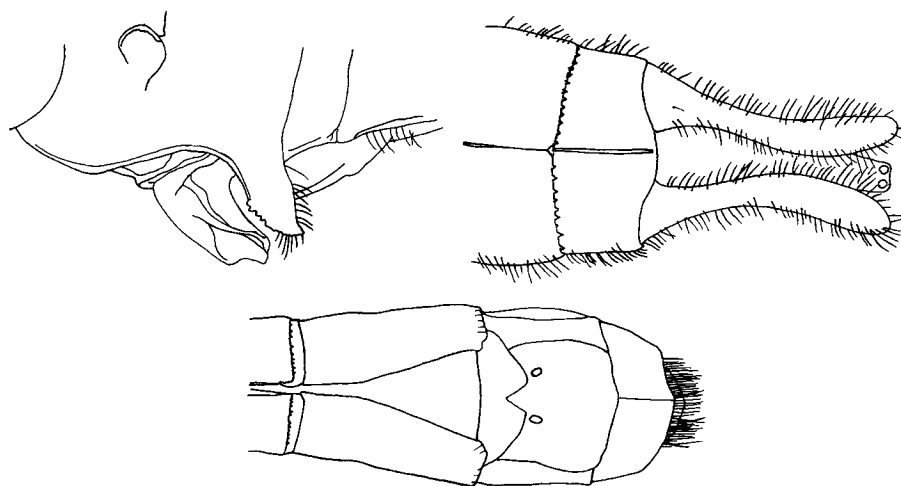


Fig. 3.2.38 *Neocordulia biancoi*: the genitalia on the second abdominal segment of the male in lateral view (upper left), the apex of the abdomen of a male in dorsal view (upper right), and the apex of the abdomen of a female in ventral view (below). Based on Rácenis (1970).

4. A large mediobasal angulation or lateral teeth or angulations or both, together with a distal or mediodistal tuft of long setae, are evident on each superior anal appendage in dorsal view (**Fig. 3.2.37**).5

- Each superior anal appendage curves evenly outward and lacks large teeth, angulations, and a tuft of long setae (**Fig. 3.2.38**).8

5. The medial ventral process on the eighth abdominal process of the male is a single conical protuberance on the proximal half, and there is a pilose area on the apical half. There is only a vestige of a dorsal keel on the tenth abdominal segment in the form of a blunt median tooth at the posterior margin. The parts of the superior anal appendages apical to the lateral prominence are approximately parallel, and there is an apical tuft of long setae (**Fig. 3.2.37**). Length of male abdomen with appendages: c. 41.2 mm. Hind wing length of male: c. 36.2 mm. Pterostigma length of male: 2.3 to 2.4 on both wings. The female has not been described. Coloration: generally shades of brown with yellow on the labrum and thorax and metallic green areas on the thorax.

.....*Neocordulia matutuensis* Machado, 2005 (Minas Gerais).

- The medial process on the eighth abdominal segment is biconical, ending in two conical processes. There are no prominent lateral processes on the outer margins of the superior anal appendages (**Fig. 3.2.39**).6

6. The superior anal appendage of the male curves laterodistad at the apex and lacks a lateral angulation in the apical third (**Fig. 3.2.39**). Total length of male: c. 54 mm. Length of male abdomen: c. 40 mm. Hind wing length of male: c. 40 mm. Coloration: Shades of brown with metallic green markings on the synthorax and a yellowish red abdomen with a dark brown tenth segment in the male.

.....*Neocordulia mambucabensis* Costa and Santos, 2000 (Rio de Janeiro).

- The superior anal appendage has a lateral angulation in the apical third (**Fig. 3.2.40**).7

7. The superior anal appendages are dark in color and their apices converge; the mediobasal projection is considerably larger than the lateral angulation and bears a small spine at the distal end. The costal area of the wing is darkened. There are no yellow or pale brown spots on the dorsal surface of the abdomen. There is only one spine on the broad internal branch of the hamule, while the external branch is narrow and has a small spine at the apex; it is not curved in the middle (**Fig. 3.2.40**). Length of male: 55 to 56 mm. Length of male abdomen: 41 to 42.5 mm. Hind wing length of male: 38.5 to 39 mm.

.....*Neocordulia setifera* (Hagen in Selys, 1871) (Minas Gerais, São Paulo, Rio de Janeiro, Paraná).

- The superior anal appendages of the male are pale in color and their apices diverge. The mediobasal angulations of each are only slightly larger than the lateral angulations and lack a spine at the distal end. The costal area of the wing is not darkened. There are two spines on the broad internal branch of the hamule, while the external branch is broad, lacks a small spine at the apex, and

is curved in the middle (**Fig. 3.2.41**). There are yellow or pale spots on the dorsal sides of the third through ninth abdominal segments. Length of male: 51 to 53 mm. Length of male abdomen: 37.5 to 40 mm. Hind wing length of male: 33 to 34 mm.

.....*Neocordulia volxemi* (Selys, 1874)
(Minas Gerais, Goiás, Mato Grosso).

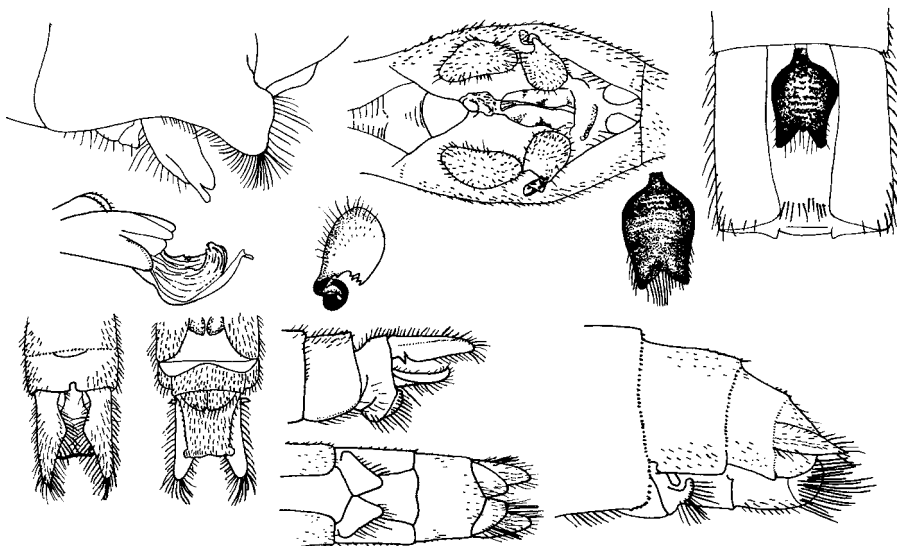


Fig. 3.2.39 *Neocordulia mambucabensis* (upper row, left to right): male genitalia on the second abdominal appendage in lateral and ventral view; eighth abdominal segment of the male in ventral view; and (middle row, left to right) penis in lateral view; hamule and lateral lobe in lateral view; biconical sternal protuberance on the eighth abdominal segment of the male; and (lower row, left to right): apex of the male abdomen in dorsal, ventral, and lateral view (above); apex of the female abdomen in ventral (below) and enlarged in lateral view. Based on Costa and Santos (2000b).

8. The costal area of the wing is darkened. The inferior anal appendage of the male is nearly acuminate and is about $\frac{4}{5}$ as long as the superior appendage. The apex of the genital lobe is acute. The median branch of the hamule is greatly reduced (**Fig. 3.2.38**). The length of the keel on the middle tibia is shorter than 10% of the tibia length. Total length: 52 to 53 mm. Length of abdomen: 38 to 40 mm. Hind wing length: 36.5 to 38 mm.

.....*Neocordulia biancoi* Rácenis, 1970
(Venezuela).

- The costal area of the wing is not darkened. The inferior anal appendage is no longer than $\frac{3}{4}$ of the length of a superior appendage, and its apex is truncate or slightly emarginate in the center. The genital lobe is not acute at the apex. The hamule has a fully developed medial branch (**Fig. 3.2.42**). The length of the keel on the middle tibia is about 40% of the tibia length.9

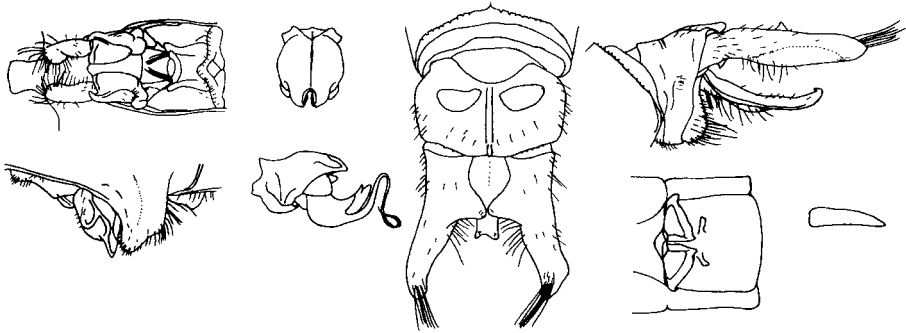


Fig. 3.2.40 *Neocordulia setifera* (left to right): male genitalia on the second abdominal segment in ventral (above) and lateral view (below), apex of the penis in ventral (above) and lateral view (below), apex of the abdomen of the male in dorsal and lateral view (above), vulvar lamina on the ninth abdominal segment of the female in ventral view (below, left), and a superior anal appendage of a female in dorsal view (below, right). Based on May (1991).

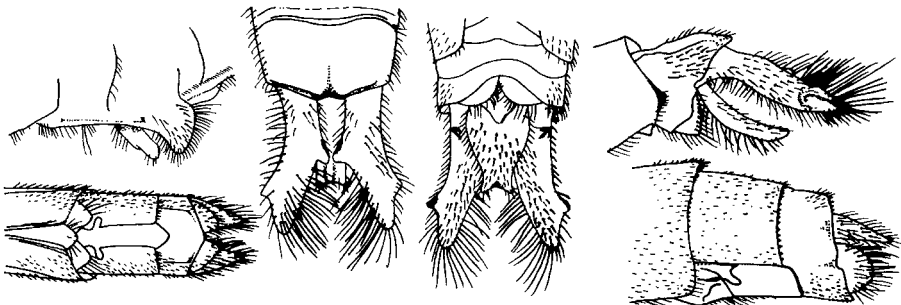


Fig. 3.2.41 *Neocordulia volxemi*: genital organs on the second abdominal segment of the male (upper left); apex of the male abdomen in dorsal (left center), ventral (right center), and lateral view (upper right); apex of the female abdomen in ventral (lower left) and lateral view (lower right). Based on Costa and Santos (2000b).

9. The posterior margin of the genital lobe is evenly rounded. The hamule is less than $\frac{1}{2}$ as long as the genital lobe, and its medial branch is not wider than its external branch, is pointed at the apex, and bears no more than two teeth. The inferior anal appendage is truncate or very slightly concave at the apex (**Fig. 3.2.42**). Length of male: 49 to 53 mm. Length of male abdomen: 36 to 39 mm. Hind wing length of male: c. 32 mm.

.....*Neocordulia androgynis* (Selys, 1871)
(Minas Gerais, São Paulo, Rio de Janeiro, Paraná, Santa Catarina). Syn:
Gomphomacromia androgynis Selys, 1871.

- The shape of the male genital lobe is quadrate with a prominent posterior excavation. The hamule, although small, is more than $\frac{1}{2}$ as long as the genital lobe, and its medial branch is much wider than its external branch and bears a row of about five denticles on its broad distal margin. The inferior anal appendage is deeply excavated at the apex to form two branches (**Fig. 3.2.43**). Length of male: 45 to 46 mm. The color of the male is mainly ochraceous with blackish markings on the apical 1/3 of each femur and the knees and brilliant metallic green markings on the antehumeral and metepisternal surfaces. The bases of the wings are golden yellow, and the membranule is light gray. The female has not been described. Length of abdomen: c. 32 mm. Hind wing length: c. 33 mm.

.....*Neocordulia carlochagasi* Santos, 1967
(Minas Gerais, São Paulo, Rio de Janeiro).

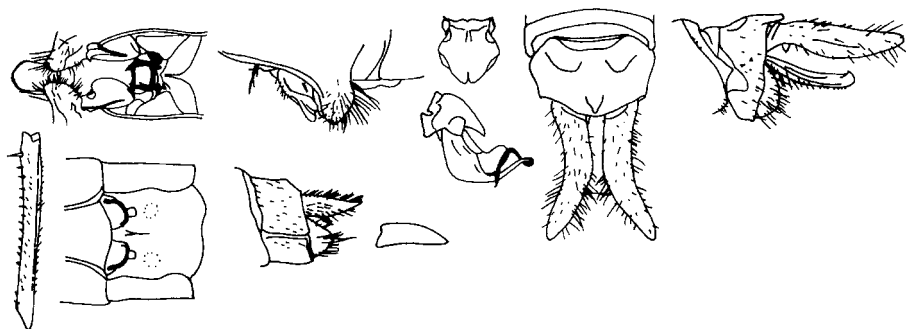


Fig. 3.2.42 *Neocordulia androgynis* (upper row, left to right): male genitalia on the second abdominal segment in ventral and lateral view, penis in ventral (above) and lateral view (below), apex of the male abdomen in dorsal and lateral view, and from a female specimen (lower left, left to right): middle tibia, ninth abdominal segment in ventral view, apex of the abdomen in lateral view, and superior anal appendage with the setae removed. Based on May (1991).

10. The costal space of the wing is darkened. The abdomen is almost entirely dark in color. The vulvar lamina on the ninth abdominal segment of the female appears as a single lobe in ventral view (**Fig. 3.2.40**). 11

- The costal space of the wing is not darkened. The abdomen has large pale areas on the dorsal surface. In ventral view, the vulvar lamina appears as two separate lobes (**Fig. 3.2.42**). 12

11. The superior anal appendages of the female and their spines are black. The eyes of the female are in contact for a distance considerably less than 1.5 mm. The spines along the anterolateral angles of the hind femora are close-set and large, so that those in the apical third are longer than $\frac{1}{2}$ of the distance between them. The vulvar lamina on the ninth abdominal segment has its apical and lateral angles produced (**Fig. 3.2.40**). Length of female: 56 to 57 mm.

.....*Neocordulia setifera* (Hagen in Selys, 1871)
(Minas Gerais, São Paulo, Rio de Janeiro, Paraná). May (1991) was not certain that the female with this description was correctly identified.

- The superior anal appendages of the female are pale. The eyes of the female are in contact for a distance greater than 1.5 mm. The pterostigma of the forewing of the female is at least 3 mm long. The tibiae of the female are pale with dark spines on the outer surface. All of those on the hind tibia are shorter than $\frac{1}{2}$ of the distance between them. The vulvar lamina is semi-elliptical with a broad notch in the middle of the posterior margin (**Fig. 3.2.38**). Total length of female: 53.5 to 54 mm. Length of female abdomen: 39.5 to 40 mm. Hind wing length of female: 41 to 42 mm.

.....*Neocordulia biancoi* Rácenis, 1970
(Venezuela).



Fig. 3.2.43 *Neocordulia carlochagasi* male (above, left to right): genitalia on the second abdominal segment in ventral view, lateral view of an auricle on the second abdominal segment, penis in lateral view, apex of the abdomen in dorsal and ventral view, and (below, left to right), genitalia in lateral view, ventral view of the eighth abdominal segment, and the apex of the abdomen in lateral view. Based on Santos (1967a).

12. The tibiae are pale on the extensor surface and sometimes entirely, but their spines are dark. The eyes of the female are in contact for a distance shorter than 0.75 mm. The abdomen of the female is grayish brown with small black spots on the dorsal surface. The lobes of the vulvar lamina are rounded and widely separated (**Fig. 3.2.42**). The pterostigma of the fore-wing of the female is usually shorter than 3 mm. Total length of female: 52 to 54.5 mm. Length of female abdomen: 37 to 38.5 mm. Hind wing length of female: 33 to 36 mm.

.....*Neocordulia androgynis* (Selys, 1871)
(Minas Gerais, São Paulo, Rio de Janeiro, Paraná, Santa Catarina).

- The tibiae and their spines are entirely dark. The eyes of the female are in contact for a distance greater than 0.75 mm. The abdomen of the female is dark with large pale brown or yellow spots on the dorsal surface. The pterostigma of the fore-wing of the female is not shorter than 3 mm. The lobes of the vulvar lamina are somewhat triangular and almost meet at the midline, forming a right angle (**Fig. 3.2.41**). Total length of female: 44 to 54 mm. Length of female abdomen: 35.5 to 40 mm. Hind wing length of female: 35.5 to 37 mm.

.....*Neocordulia volxemi* (Selys, 1874)
(Minas Gerais, Goiás, Mato Grosso).

Key to the species of *Neocordulia* larvae in South America

Information for the key was provided by DeMarmels (1990a) and Costa and Santos (2000a, b).

1. The abdomen is almost twice as long as wide at its widest point, and it is marked with prominent dark markings on the dorsal surface of the sixth through ninth segments. The epiproct is shorter than the paraprocts but longer than the cerci (**Fig. 3.2.44**).

.....*Neocordulia biancoi* Rácenis, 1970
(Venezuela).

- The abdomen is no more than about 1.5 times as long as wide at its widest point, and it has no prominent dark markings (**Fig. 3.2.45**).2

2. The lateral spines on the eighth and ninth abdominal segments do not reach the bases of the segments distal to them. The epiproct is shorter than the cerci, and its distal end is truncate; the cerci are shorter than the paraprocts (**Fig. 3.2.45**).

.....*Neocordulia androgynis* (Selys, 1871)
(Minas Gerais, São Paulo, Rio de Janeiro, Paraná, Santa Catarina).

- The lateral spines on the eighth and ninth abdominal segments are short but reach the bases of the next segments. The epiproct is shorter than the paraprocts and longer than the cerci, and its distal end is acutely pointed (**Fig. 3.2.35**).

.....*Neocordulia setifera* (Hagen in Selys, 1871)
(Minas Gerais, São Paulo, Rio de Janeiro, Paraná).

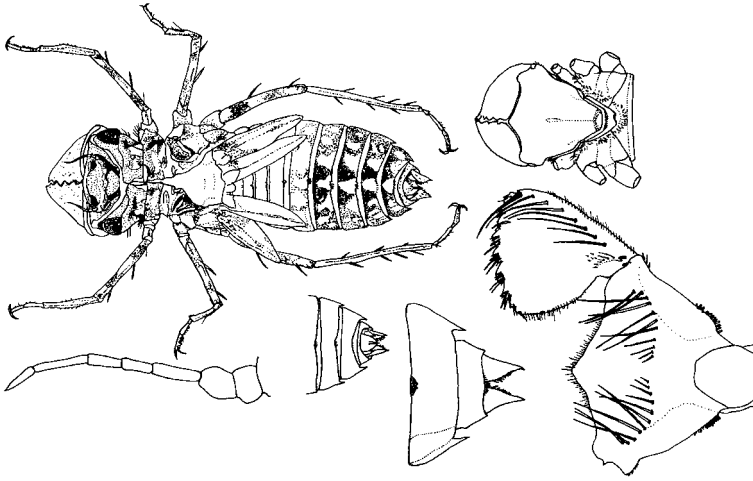


Fig. 3.2.44 *Neocordulia biancoi* larva: habitus of a female exuvia (upper left), antenna of a male (lower left), labium of a male in ventral view (upper right), labium with the left palp removed (lower right), apex of the abdomen of a female in dorsal (lower left center) and ventral view (lower right center). Based on DeMarmels (1990a).

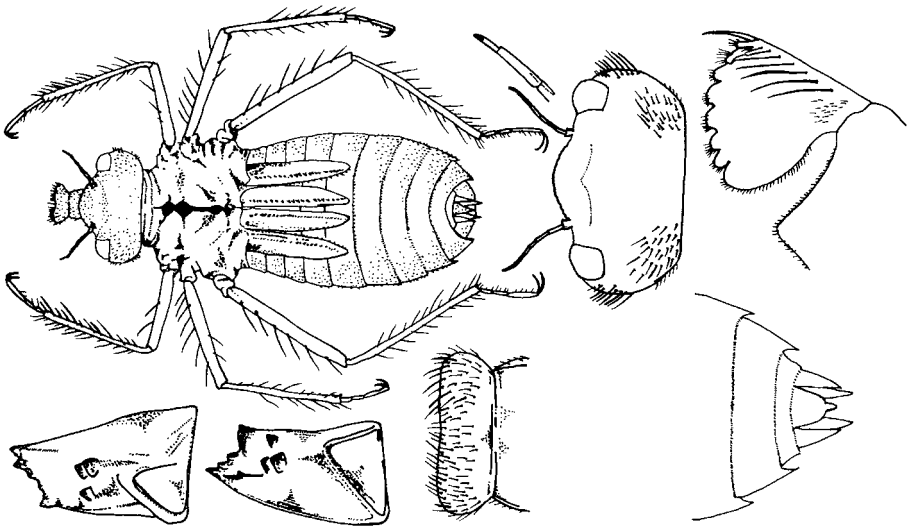


Fig. 3.2.45 *Neocordulia androgynis* larva: habitus from an exuvia (upper left), head with an enlargement of the apical segments of the antenna to its upper left (upper right center), labial palp (upper right), left (lower left) and right mandible (lower left center), labrum (lower center), and apex of the abdomen (lower right). Based on Costa and Santos (2000a).

Key to the species of adult *Gomphomacromia* in South America

Information for the key was provided by Ris (1918, 1928a), Fraser (1957, 1958a), Jurzitza (1981), and von Ellenrieder (2000b). Most larvae are unknown.

1. The antehumeral spot is very small or absent. There is a complete, narrow, pale stripe on the metepisternum that crosses the metastigma to form a thin seam on the metepimeron, as well (**Fig. 3.2.46**). The male lacks a pale dorsal spot on the eighth segment, or the spot is minute. There is one elongate lateral marking posterior to the pale band in which the spiracle is located. The pale band is barely wider than the spiracle itself. There is a faint yellow clouding at the base of the fore-wing of both sexes. The end of the process on the eighth sternite of the female is somewhat elliptically broadened. Length of abdomen of male: 28 to 30 mm; female: 30 to 31 mm. Hind wing length of male: 25 to 27 mm; female: c. 29 mm.

.....*Gomphomacromia fallax* MacLachlan, 1881
(Ecuador, Peru, Bolivia, Brazil).

- The antehumeral spot is always present and relatively large. Stripes or spots on the metepisternum do not cross the entire plate as a uniform stripe. The male has a pale dorsal double spot on the eighth segment. There is an obvious yellow or yellow-brown cloud at the base of the fore-wing of both sexes (**Fig. 3.2.47**).

.....2



Fig. 3.2.46 Diagram of the color pattern on the synthorax of a male *Gomphomacromia fallax*. Based on Ris (1928a).

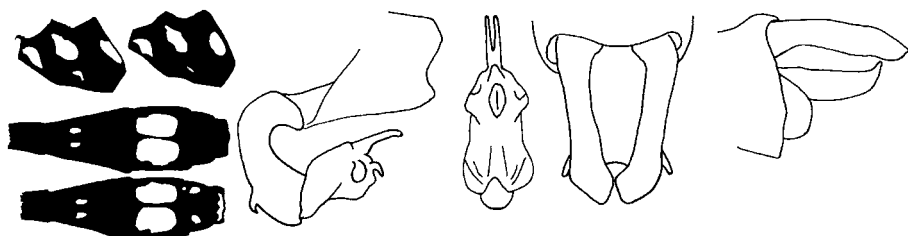


Fig. 3.2.47 *Gomphomacromia paradoxa* male (left to right): lateral color pattern on the synthorax of two specimens (above) and the dorsal color pattern on the seventh through tenth abdominal segments (below), penis in lateral and ventral view, apex of the abdomen in dorsal and lateral view. Based on Jurzitza (1981).

2. Pale mesepisternal stripes are absent. The spiracle touches the posterior border of the anteriormost pale lateral marking on the thorax. There is no yellow oval marking at the dorsal margin of the synthorax. The fourth through seventh abdominal segments of the male are entirely black, and the tenth segment is entirely yellow (**Fig. 3.2.48**).

.....*Gomphomacromia chilensis* Martin, 1921
(Chile).

- Pale mesepisternal stripes are present. The spiracle lies within the third pale lateral marking on the thorax, or the yellow marking on the thorax does not reach the spiracle. The fourth through seventh abdominal segments of the male are black with a pair of yellow spots, and the tenth segment is entirely or partially black (**Fig. 3.2.49**).3

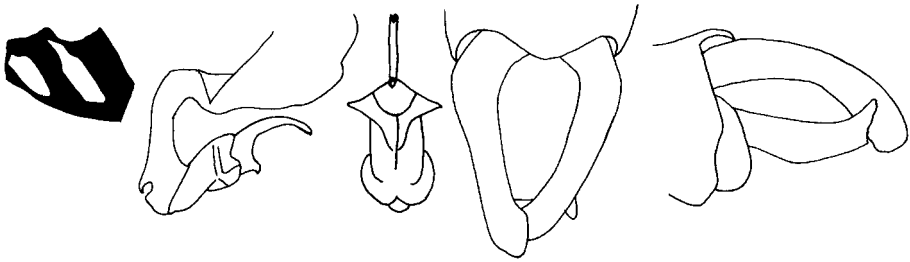


Fig. 3.2.48 *Gomphomacromia chilensis* male (left to right): lateral color pattern on the synthorax, penis in lateral and ventral view, apex of the abdomen in dorsal and lateral view. Based on Jurzitza (1981).

3. In dorsal view, the superior anal appendages of the male diverge at the apices. The superior anal appendage of the female is 0.24 to 0.25 times as long as the vulvar scale. The yellow markings on the side of the thorax do not reach the spiracle. The spiracle lies within the third pale lateral marking on the thorax. There are two small, pale, elliptical, lateral marks on the thorax posterior to the pale marking in which the spiracle is located. The light area on the metepisternum forms a narrow stripe that can continue on to the mesepimeron. The basic color of the thorax and abdomen is brown, but a diffuse blackish coloration surrounds the light areas. The pale dorsal areas on the third through seventh abdominal segments are elongated longitudinally. Both sexes have a small yellow spot in the distal cell beside the nodus. The end of the process on the eighth sternite of the female is somewhat elliptically broadened (**Fig. 3.2.26**). Length of abdomen of male: 25.8 to 27.3 mm; female: 28.1 to 28.6 mm. Hind wing length of male: 25.1 to 27.3 mm; female: 28.8 to 29.2 mm. Pterostigma length in hind wing of male: 1.8 to 2.1 mm; female: c. 2.5 mm.

.....*Gomphomacromia nodisticta* Ris, 1928
(Argentina).

- In dorsal view, the superior anal appendages of the male converge at the apices (**Fig. 3.2.49**). The superior anal appendage of the female is 0.18 to 0.20 times as long as the vulvar scale.4

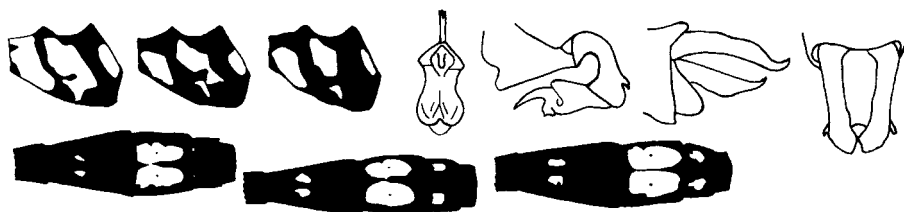


Fig. 3.2.49 *Gomphomacromia etcheverryi* male (above, left to right): lateral color pattern on the synthoraces of three specimens, penis in ventral and lateral view, and the apex of the abdomen in lateral and dorsal view, and (below) the dorsal color pattern on the seventh through tenth abdominal segments of three specimens. Based on Jurzitza (1981).

4. The distal cornu of the penis is forked for $\frac{1}{2}$ of its length. The yellow markings on the side of the thorax do not reach the spiracle. The light area on the metepisternum is either broken into two spots or it forms a large rectangle covering much of the mesepimeron, as well. The basic color of the thorax is very dark reddish brown, and that of the abdomen is black. The pale dorsal areas on the third abdominal segment is somewhat rhomboid, and those on the fourth through seventh abdominal segments are circular. The wings are distinctly colored at the base, those of the female somewhat more extensively than the males. The wing of the female is yellow at the base, or it is completely yellow except for the very tip. The end of the process on the eighth sternite of the female is bluntly rounded but not at all broadened (**Fig. 3.2.47**). Length of abdomen of male: 23 to 25 mm; female: 25 to 26 mm. Hind wing length of male: 21 to 24 mm; female: 24 to 26 mm.

.....*Gomphomacromia paradoxa* Brauer, 1864 (Chile, Argentina, Peru). Syn: *Gomphomacromia paradoxa* var. *effusa* Navás, 1918; *Gomphomacromia paradoxa* var. *tincta* Navás, 1918; *Cordulia chilensis* Hagen, 1861, *nomen nudum*.

- The distal cornu of the penis is forked for only $\frac{1}{4}$ of its length, and the sides of the basal portion of the penis are concave (**Fig. 3.2.49**). The coloration is very similar to that of *G. paradoxa*. Length of abdomen of male: 25 to 27 mm; female: 26 to 30 mm. Hind wing length of male: 23 to 25 mm; female: 25 to 27 mm.

.....*Gomphomacromia etcheverryi* Fraser, 1958 (Chile, Argentina). There is considerable doubt that this is a valid species. It is sometimes considered to be a synonym of *Gomphomacromia paradoxa*.

Key to the species of adult male *Lauromacromia* in South America

Information for the key was provided by Machado (2002a) and Carvalho *et al.* (2004). Specimens of this genus are rare in collections, and few descriptions of females or larvae are available.

1. There is no tubercle on the ventral side of the superior anal appendage that is visible in lateral view, and the apices of these appendages are acute and sharply diverge. On the tenth abdominal segment, there are deep depressions on either side of the middorsal carina and its triangular crest. The tenth abdominal segment and superior anal appendage are about equal in length (**Fig. 3.2.50**). The head is uniformly reddish brown. The metepimeral stripes are not interrupted, and the eighth through tenth abdominal segments lack pale spots. Abdomen length with appendages: c. 36.5 mm. Hind wing length: c. 32 mm. Length of pterostigma in fore-wing: c. 1.6 mm.

..... *Lauromacromia dubitalis* (Fraser, 1939)
(Venezuela, Ecuador, French Guiana). Syn: *Gomphomacromia dubitalis* Fraser, 1939.

- There is a tubercle on the ventral side of the superior anal appendage that is visible in lateral view, and the apices of these appendages are directed posteriad. On the tenth abdominal segment, there are no depressions beside the middorsal carina and its crest. The tenth abdominal segment is only about 2/3 the length of the superior anal appendage or shorter (**Fig. 3.2.51**). The head is uniformly yellowish, yellow and olive, or brown and orange. The length of the pterostigma in the fore-wing is about 2.0 to 2.5 mm.2

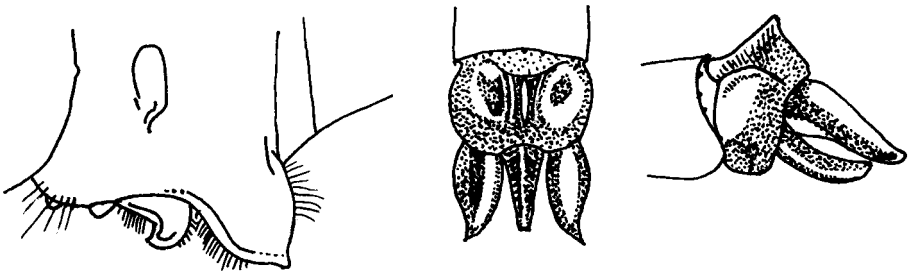


Fig. 3.2.50 *Lauromacromia dubitalis* male (left to right): genitalia on the second abdominal segment in lateral view and the apex of the abdomen in dorsal and lateral view. Based on Giejskes (1970).

2. The head is uniformly yellow. The lateral thoracic stripe is straight and reaches a width of about 1.1 mm in the middle. The metepimeral stripe is discontinuous. The costal vein is brown. The eighth through tenth abdominal segments have pale spots, and the tenth segment has a dorsal crest that is

rectangular in cross-section (**Fig. 3.2.51**). Abdomen length: 36.8 mm. Fore-wing length: 33.1 mm. Only one specimen has been described.

.....*Lauromacromia luismoojeni* (Santos, 1967)
(Brasília). Syn: *Neocordulia luismoojeni* Santos, 1967.

- The head is not uniformly yellow. The metepimeral stripe is not interrupted. At least the ninth and tenth abdominal segments lack pale dorsal and lateral spots, and the tenth segment has a dorsal crest that is triangular in cross-section (**Fig. 3.2.52**).3

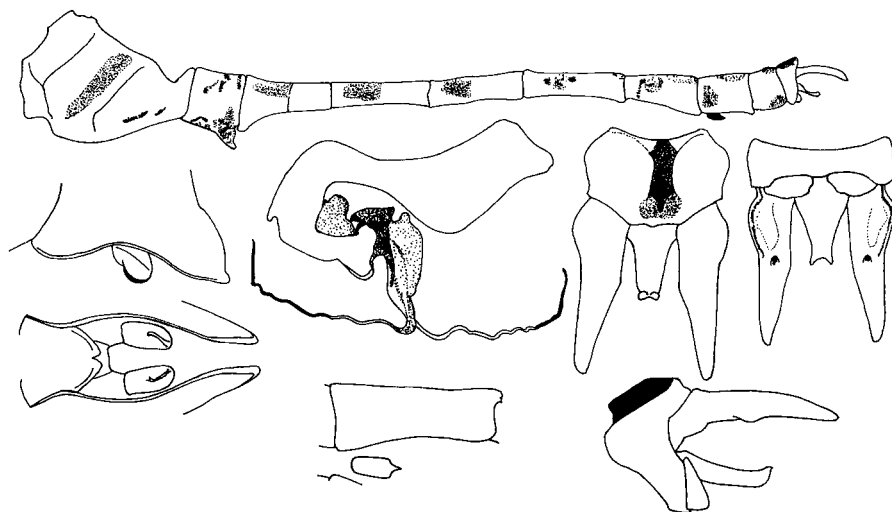


Fig. 3.2.51 *Lauromacromia luismoojeni* male: color pattern on the thorax and abdomen in lateral view (above), the genitalia on the second abdominal segment in lateral (middle left) and ventral view (lower left), the penis in lateral view (left center), the eighth sternite in ventral view (lower center), and the apex of the abdomen in dorsal (right center), ventral (middle right), and lateral view (lower right). Based on Santos (1967b).

3. The costal vein is yellow. The head is mainly olive brown, but the labrum, labium, and anterior surface of the frons are orange. The lateral thoracic stripe is somewhat concave along its dorsal surface, and it reaches a width of only about 0.6 mm in the middle (**Fig. 3.2.27**). The metepimeral stripe is not interrupted. Total length: 54.2 mm. Length of abdomen without appendages: 38.2 mm. Hind wing length: 34.4 mm. Only one specimen has been described.

.....*Lauromacromia flaviae* Machado, 2002
(Minas Gerais).

- The costal vein is brown or black. The head is mainly olive and brown, but a few dark areas and ochraceous and lighter yellow markings are present on the labrum, prementum, labial palps, and clypeus. The lateral thoracic stripe is not notably concave along its dorsal surface. Total length: 49 to 51 mm. Length of

abdomen without appendages: 34.5 to 37.5 mm. Hind wing length: 32 to 35 mm. The description also applies to the female. The apical section of the superior anal appendage of the male tapers gradually to a point (**Fig. 3.2.52**).

....*Lauromacromia picinguaba* Carvalho, Salgado, & Werneck-de-Carvalho, 2004 (São Paulo).

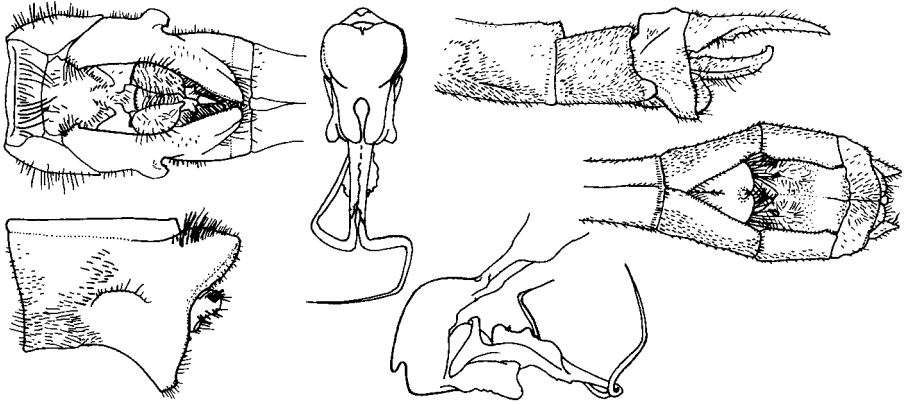


Fig. 3.2.52 *Lauromacromia picinguaba*: genitalia on the second abdominal segment of the male in ventral view (upper left) and the second segment in lateral view with the genitalia to the right (lower left), penis in ventral (left center) and lateral view (lower center), apex of the male abdomen in lateral view (upper right), and apex of the female abdomen in ventral view (middle right). Based on Carvalho *et al.* (2004).

Key to the species of adult *Aeschnosoma* in South America

Information for the key was provided by Geijskes (1970) and Santos (1981a).

1. The synthorax is uniformly brown, and the legs are light brown. Both wings of the female have a golden yellow basal spot extending to or including the triangle on the hind wing. The anal area has four rows of cells beyond the loop. There are about 30 cells in the anal loop. The superior anal appendage of the female is about twice as long as the tenth abdominal segment (**Fig. 3.2.53**). Total length: c. 49 mm. Length of abdomen with appendages: c. 37 mm. Hind wing length: c. 41 mm. Pterostigma length in fore-wing: c. 2.3 mm; in hind wing: c. 2.1 mm. Known from the female only.

.....*Aeschnosoma auripennis* Geijskes, 1970 (Surinam).

- The synthorax has yellow lateral stripes. The legs are dark brown or black, except sometimes the coxa. The wings are hyaline or evenly tinged with light brown. The anal area of the hind wing has two or three rows of cells. There are usually fewer than 30 cells in the anal loop (**Fig. 3.2.54**).2

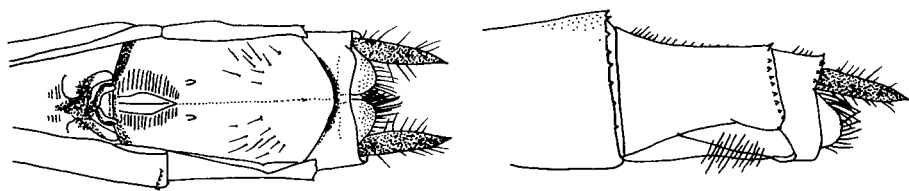


Fig. 3.2.53 The apex of the abdomen of a female *Aeschnosoma auripennis* in ventral (left) and lateral view (right). Based on Giejskes (1970).

2. The synthorax has four yellow lateral stripes on each side. Each fore-wing has 14 to 18 antenodal cross veins, and the hind wing has two cubital cross veins. The superior anal appendages of the male are as long as the inferior appendage. The basal segment of the penis has two blunt lateral processes (**Fig. 3.2.54**). Total length: 47 to 51 mm. Hind wing length: 33 to 38 mm. Length of abdomen with appendages: 35 to 40 mm. Pterostigma length: 2.0 to 2.2 mm.

.....*Aeschnosoma forcipula* Selys, 1871
(Guyana, French Guiana, Surinam, Venezuela, Peru, Pará, Amazonas). Syn: *Aeschnosoma peruviana* Cowley, 1934.

- The synthorax has three yellow lateral stripes on each side. The fore-wing has more than 16 or less than 14 antenodal cross veins, and hind wing has two or more cubital cross veins (**Fig. 3.2.55**).3

3. The lengths of the abdomen and hind wing are each about 27 mm. Fore-wing with 11 antenodal cross veins. Hind wing with two cubital cross veins. The anal loop has 16 cells (**Figs. 3.2.3, 3.2.25**). Last three abdominal segments are depressed. Total length: c. 49 mm. Only the male has been described.

.....*Aeschnosoma rustica* Selys, 1871
(Bahía).

- The abdomen and hind wing are each longer than 30 mm. There are at least 13 antenodal cross veins in the fore-wing. There are usually at least three cubital cross veins. The anal loop has at least 18 cells. The last three abdominal segments of the male are not depressed (**Fig. 3.2.55**).4

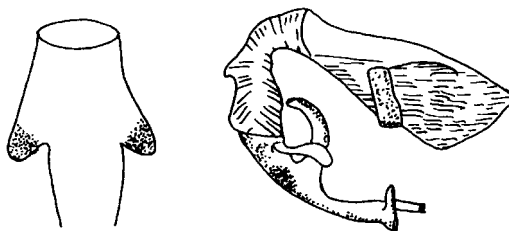


Fig. 3.2.54 *Aeschnosoma forcipula* male: basal segment of the penis in ventral view (left) and penis in lateral view (right). Based on Santos (1981a).

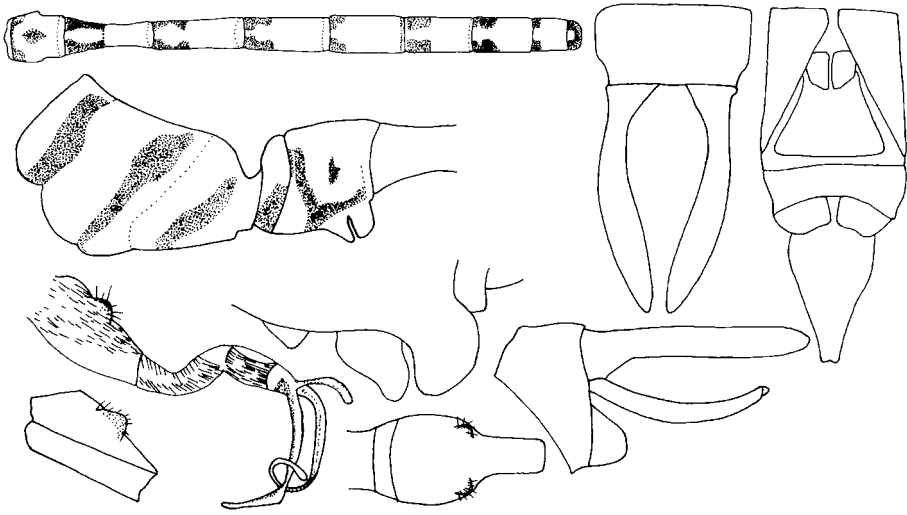


Fig. 3.2.55 *Aeschnosoma marizae* male: color pattern on the abdominal segments in dorsal view (above left), the synthorax and two anterior abdominal segments in lateral view (upper middle left), outline of the male genitalia on the second abdominal segment in lateral view (center), penis in lateral view (lower middle left), the basal segment of the penis in oblique (lower left) and ventral view (lower center), apex of the abdomen in dorsal (upper right center), ventral (upper right), and lateral view (lower right). Based on Santos (1981a).

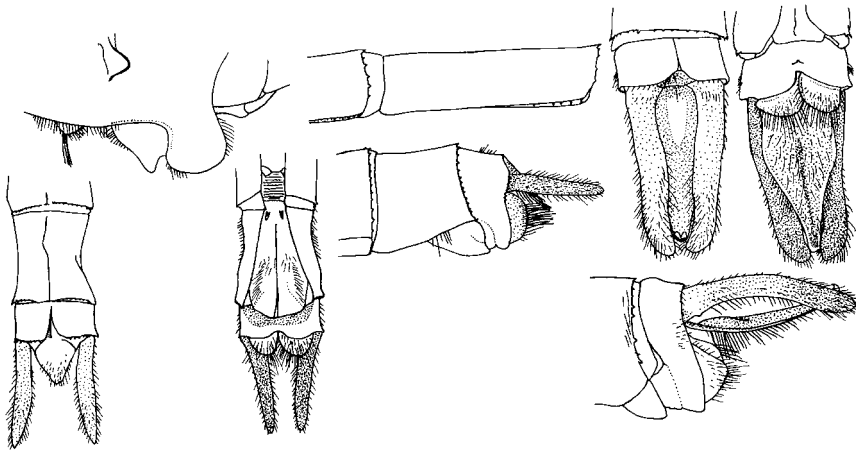


Fig. 3.2.56 *Aeschnosoma elegans* (above, left to right): male genitalia and auricle on the second abdominal segment in lateral view, posterior part of the seventh and the eighth abdominal segment in lateral view, apex of the male abdomen in dorsal and ventral view, and (below, left to right): apex of the female abdomen in dorsal, ventral, and lateral view, and apex of the male abdomen in lateral view. Based on Geijskes (1970).

4. Length of abdomen and hind wing: about 33 mm each. The fore-wing has 13 to 15 antenodal cross veins and six to eight post-nodal cross veins. The hind wing has eight or nine post-nodal cross veins and three or four cubital cross veins. The anal loop has 17 to 21 cells. The superior anal appendage of the male is about $\frac{3}{4}$ as long as the inferior appendage (**Fig. 3.2.55**).

.....*Aeschnosoma marizae* Santos, 1981
(Goiás, Brasília).

- Length of abdomen: 44 to 46 mm. Length of hind wing: 41 to 44 mm. The fore-wing has 16 to 20 antenodal cross veins. In the fore-wing, there are usually 10 post-nodal cross veins, and the in the hind wing, there are 12 to 14. The hind wing has four or five cubital cross veins. The anal loop has 24 to 36 cells. The superior anal appendages of the male are about as long as the inferior appendage (**Fig. 3.2.56**). Total length: c. 65 mm. Length of abdomen with appendages: c. 49 mm. Hind wing length: c. 46 mm. Pterostigma length in both wings: c. 3 mm.

.....*Aeschnosoma elegans* Selys, 1871
(Guyana, Surinam, Pará).

Key to the species of the known larvae of *Aeschnosoma*

Information for the key was provided by Geijskes (1970). Descriptions of the larvae of *Aeschnosoma elegans* and *Aeschnosoma rustica* are not available.

1. The lateral spine on the ninth abdominal segment is four to five times the combined median dorsal length of the ninth and tenth abdominal segments. The eighth abdominal segment has straight lateral spines directed caudad and reaching the base of the spines on the ninth segment. There are one row and two groups of four or five curved setae between the antennae. The labium has 10 mental setae and about 20 strong setae along the outer margin of the prementum. The lateral lobe has 7 setae and about 12 crenulations along the outer margin (**Fig. 3.2.57**). Total length: c. 27 mm.

.....*Aeschnosoma forcipula* Selys, 1871
(Guyana, French Guiana, Surinam, Venezuela, Peru, Pará, Amazonas). Syn: *Aeschnosoma peruviana* Cowley, 1934.

- The lateral spine on the ninth abdominal segment is no more than three times the combined median dorsal length of the ninth and tenth abdominal segments. The lateral lobe has 8 setae and 9 to 15 crenulations along the outer margin (**Fig. 3.2.58**).

2. The lateral spine on the ninth abdominal segment is three times the median dorsal length of the ninth segment. The lateral lobe of the labium has three short setae at the base and nine crenulations along the outer margin (**Fig. 3.2.58**). There are two groups of about seven curved setae between the antennae. Total length: c. 24 mm.

.....*Aeschnosoma auripennis* Geijskes, 1970
(Surinam).

- The lateral spine on the ninth abdominal segment is obviously longer than the combined median dorsal length of the ninth and tenth abdominal segments. The lateral lobe of the labium has 10 short setae at the base and 15 crenulations along the outer margin (Fig. 3.2.33).

.....*Aeschnosoma marizae* Santos, 1981
(Goiás, Distrito Federal)

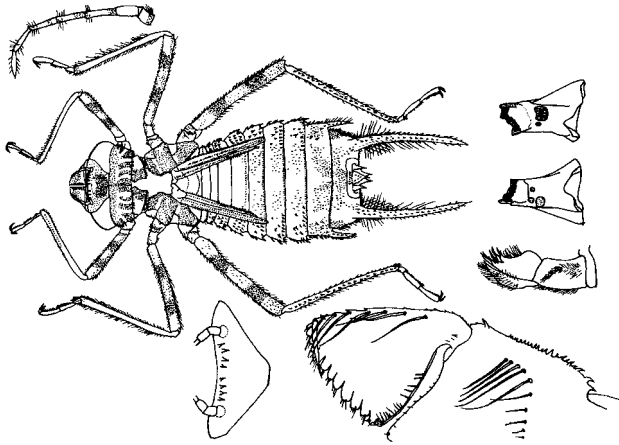


Fig. 3.2.57 *Aeschnosoma forcipula* larva: habitus (middle left), antenna (upper left), the vertex of the head of a larval exuvium (lower left), half of the mentum with its lateral lobe (lower right), the inner surfaces of the left and right mandibles (upper right, above and below, respectively), and a ventral view of the maxilla (lower middle right). Based on Geijskes (1970).



Fig. 3.2.58 *Aeschnosoma auripennis* larva (left to right): antenna (above); vertex of an exuvia (below); right half of labium; lateral spines on the eighth and ninth abdominal segments in dorsal view. Based on Giejskes (1970).

Key to the species of adult male *Navicordulia* in South America

Information for the key was provided by Machado and Costa (1995). The males of *Navicordulia amazonica* and *N. miersi* have not yet been described.

1. Each superior anal appendage is from 2.5 to 2.9 mm long, clearly longer than the inferior appendage, and fringed with long, hair-like, laterally or dorsally directed setae on the apical half (**Fig. 3.2.59**).2
- Each superior anal appendage is from 1.6 to 2.0 mm long, shorter or only slightly longer than the inferior appendage, and lacking dense laterally or dorsally directed setae on the apical half (**Fig. 3.2.60**).4

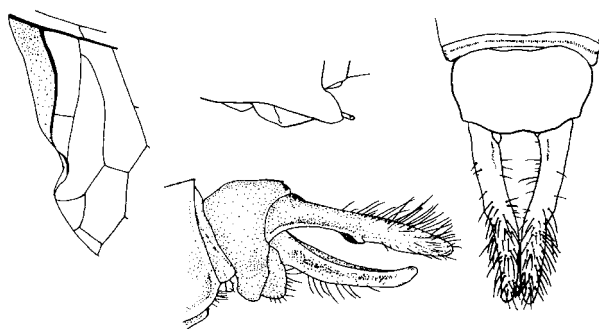


Fig. 3.2.59 *Navicordulia kiautai* male: anal triangle and membranule on the hind wing (left), genitalia on the second abdominal segment in lateral view (upper center), apex of the abdomen in dorsal (right) and lateral view (lower center). Based on Machado and Costa (1995).

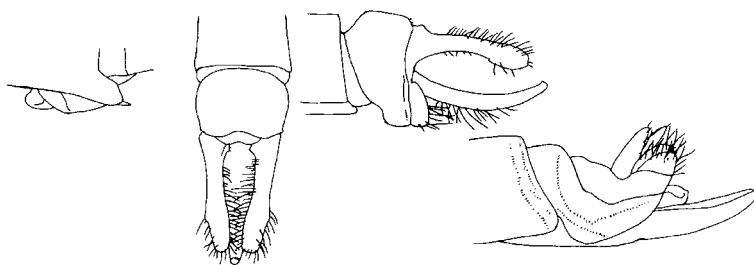


Fig. 3.2.60 *Navicordulia mielkei* (left to right): genitalia on the second abdominal segment of a male in lateral view, apex of the male abdomen in dorsal and lateral view, and apex of the female abdomen in lateral view. Based on Machado and Costa (1995).

2. The distal part of the superior anal appendage without a carina is clearly shorter than the proximal part with a carina, and in dorsal view, a concave indentation is apparent along the external edge about 2/3 of the way from the

base to the apex of the appendage. The genital lobe is roughly triangular (**Fig. 3.2.12**). Total length: c. 43.5 mm. Length of abdomen: c. 28.9 mm. Hind wing length: c. 31.5 mm.

.....*Navicordulia nitens* (DeMarmels, 1991)
(Chile, Argentina). Syn: *Dorocordulia nitens* DeMarmels, 1991.

- The distal part of the superior anal appendage without a carina is nearly as long or longer than the proximal part with a carina, and in dorsal view, there is no concave indentation along the external edge. The genital lobe is roughly quadrangular (**Fig. 3.2.59**).3

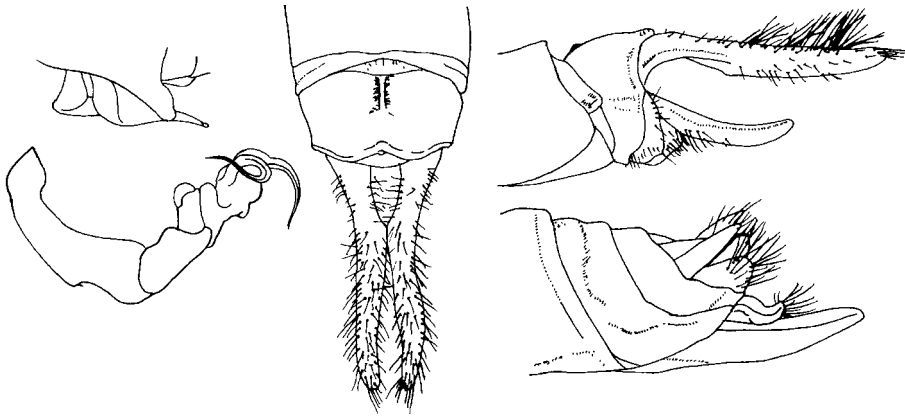


Fig. 3.2.61 *Navicordulia longistyla*: genitalia on the second abdominal segment in lateral view (upper left), penis in lateral view (lower left), apex of the male abdomen in dorsal (center) and lateral view (upper right), and apex of the female abdomen in lateral view (lower right). Based on Machado and Costa (1995).

3. The distal part of the superior anal appendage without a carina is approximately as long as the proximal part with a carina, and in dorsal view, its sides near the apex are parallel or slightly divergent. At midlength, this appendage bears two small ventral tubercles, one near the middle and the other near the lateral edge (**Fig. 3.2.59**). The maximal width of the abdomen is about 3.0 mm. Total length: 46.0 to 47.5 mm. Length of abdomen: 31.3 to 31.7 mm. Hind wing length: 31.5 to 32.0 mm.

.....*Navicordulia kiautai* Machado and Costa, 1995
(Minas Gerais).

- The distal part of the superior anal appendage without a carina is much longer than the proximal part with a carina, and in dorsal view, its sides near the apex are slightly convergent. This appendage bears only one small ventral tubercle

located near the middle about one third of the distance from the base to the apex, (Fig. 3.2.61). The maximal width of the abdomen is 2.3 to 2.4 mm. Total length: 43.0 to 45.7 mm. Length of abdomen: 29.6 to 31.4 mm. Hind wing length: 28.9 to 30.4 mm.

.....*Navicordulia longistyla* Machado and Costa, 1995 (Brasilia).

4. The superior anal appendages are clearly shorter than the inferior appendage (Fig. 3.2.60). Total length: 41.3 to 44.0 mm. Length of abdomen: 29.6 to 31.4 mm. Hind wing length: 29.5 to 30.6 mm. Coloration: orange and shades of brown with metallic green on the dorsal surface of the abdomen.

.....*Navicordulia mielkei* Machado and Costa, 1995 (Santa Catarina).

- The superior and inferior anal appendages are nearly equal in length (Fig. 3.2.62).5

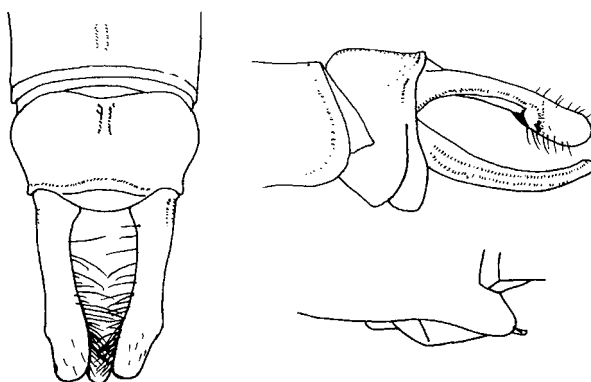


Fig. 3.2.62 *Navicordulia atlantica* male: genitalia on the second abdominal segment in lateral view (lower right), apex of the abdomen in dorsal (left) and lateral view (upper right). Based on Machado and Costa (1995).

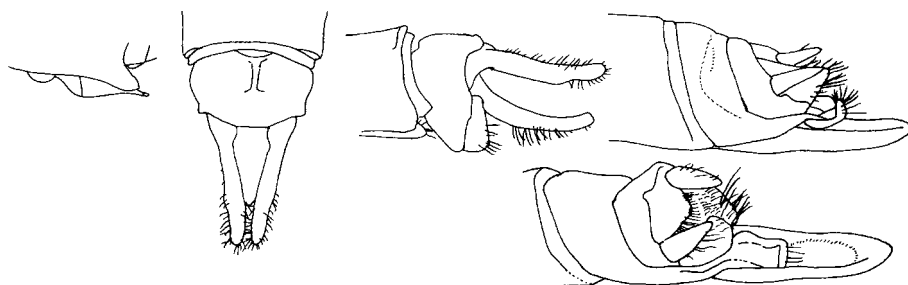


Fig. 3.2.63 *Navicordulia leptostyla* (left to right): genitalia on the second abdominal segment of a male in lateral view, apex of the male abdomen in dorsal and lateral view, and apex of the female abdomen in lateral (above) and dorsolateral view (below). Based on Machado and Costa (1995).

5. There is a tubercle on the ventrolateral surface of the superior anal appendage (**Fig. 3.2.62**).6

- There is no tubercle on the ventrolateral surface of the superior anal appendage. The genital lobe is roughly triangular (**Fig. 3.2.63**).7

6. The distal part of the superior anal appendage without a carina is only about $\frac{1}{4}$ the length of the proximal part with a carina. The genital lobe is roughly triangular (**Fig. 3.2.64**). Total length: c. 30 mm. Length of abdomen: c. 25.5 mm. Hind wing length: c. 28 mm.

.....*Navicordulia vagans* (DeMarmels, 1989)
(Venezuela). Syn: *Dorocordulia vagans* DeMarmels, 1989.

- The distal part of the superior anal appendage without a carina is about $\frac{1}{2}$ the length of the proximal part with a carina. The genital lobe is roughly quadrangular (**Fig. 3.2.62**). Hind wing length: c. 31 mm.

.....*Navicordulia atlantica* Machado and Costa, 1995
(Santa Catarina).

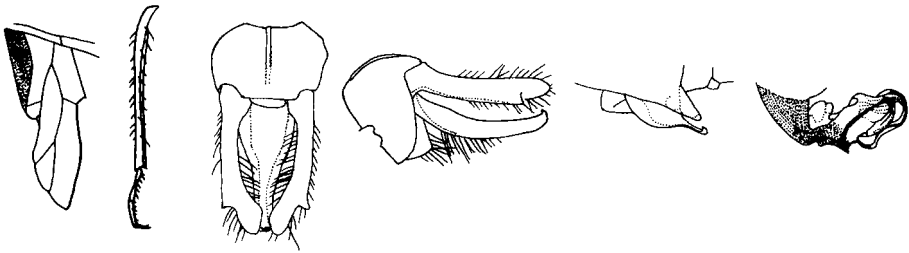


Fig. 3.2.64 *Navicordulia vagans* male (left to right): membranule and basal part of the hind wing, hind tibia and tarsi, apex of the abdomen in dorsal and lateral view, genitalia on the second abdominal segment in lateral view, and penis in lateral view. Based on DeMarmels (1989a).

7. The costal vein is brown. The distal end of the superior anal appendage is dilated (**Fig. 3.2.30**). Total length: 36 to 39 mm. Length of abdomen: 24.0 to 26.6 mm. Hind wing length: 26.0 to 28.5 mm.

.....*Navicordulia errans* (Calvert, 1909)
(Goiás, São Paulo, Brasília, Mato Grosso?). Syn: *Dorocordulia errans* Calvert, 1909.

- The costal vein is white. The distal end of the superior anal appendage narrows slightly toward the apex (**Fig. 3.2.63**). Total length: 36.5 to 39.0 mm. Length of abdomen: 24.5 to 25.4 mm. Hind wing length: 23.8 to 24.6 mm.

.....*Navicordulia leptostyla* Machado and Costa, 1995
(Goiás, Brasília).

Key to the species of adult female *Navicordulia* in South America

Information for the key was provided by Santos (1968a) and Machado and Costa (1995). The females of *Navicordulia atlantica*, *N. kiautai*, and *N. vagans* have not yet been described.

1. The membranule and pterostigma are black. The tergal extensions of the ninth abdominal segment taper posteriad beyond the supralaminar process. Length of abdomen: c. 34 mm. Hind wing length: c. 33 mm.

.....*Navicordulia nitens* (DeMarmels, 1991)
(Chile, Argentina). Syn: *Dorocordulia nitens* DeMarmels, 1991.

- The membranule is light to medium brown, and the pterostigma is brownish or yellow. The tergal extensions of the ninth abdominal segment taper posteriad but do not extent beyond the supralaminar process (**Fig. 3.2.65**).2

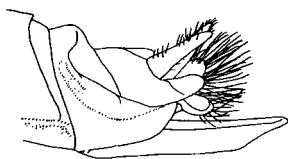


Fig. 3.2.65 *Navicordulia miersi*: apex of the female abdomen in lateral view. Based on Machado and Costa (1995).

2. In the hind wing, there are two cubitoanal cross veins. The supralaminar process resembles a small dish and appears wider than the vulvar lamina in dorsoposterior view (**Fig. 3.2.65**). Total length: c. 45.5 mm. Length of abdomen: c. 36 mm. Hind wing length: c. 32.7 mm.

.....*Navicordulia miersi* Machado and Costa, 1995
(Santa Catarina).

- In the hind wing, there is one cubitoanal cross vein. The supralaminar process appears narrower than the vulvar lamina in dorsoposterior view (**Fig. 3.2.66**).

.....3
3. The apex of the supralaminar process is directed posteriad or dorsoposteriad (**Fig. 3.2.61**)4

- The supralaminar process is tongue-shaped with an apex curved dorsad (**Fig. 3.2.66**).5

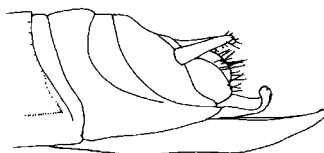


Fig. 3.2.66 *Navicordulia amazonica*: apex of the female abdomen in lateral view. Based on Machado and Costa (1995).

4. The supralaminar process is shaped like a spoon directed dorsoposteriad and is armed with a tuft of hair-like setae (**Fig. 3.2.61**). Total length: c. 47 mm. Length of abdomen: c. 33.6 mm. Fore-wing length: c. 33.4 mm.

.....*Navicordulia longistyla* Machado and Costa, 1995 (Brasília).

- The supralaminar process is shaped like a cup and is not armed with a tuft of setae (**Fig. 3.2.60**). Total length: 37 to 46 mm. Length of abdomen: 33.5 to 35.0 mm. Fore-wing length: 32.0 to 34.8. Hind wing length: 31.0 to 33.0 mm.

.....*Navicordulia mielkei* Machado and Costa, 1995 (Santa Catarina).

5. The costal vein is white, and the other veins are brown (**Fig. 3.2.63**). Total length: 36.0 to 38.5 mm. Length of abdomen: 25.1 to 27.4 mm. Hind wing length: 24.5 to 27.2 mm.

.....*Navicordulia leptostyla* Machado and Costa, 1995 (Goiás, Brasília).

- The costal vein is brown.6

6. Two cells separate the anal loop from the wing margin, or, in only one place, three cells separate them. The setae at the apex of the female abdomen reach almost to the posterior end of the ovipositor (**Fig. 3.2.30**). Total length: 38.9 to 41.5 mm. Abdomen length: 27 to 31 mm. Hind wing length: 29.0 to 32.3 mm.

.....*Navicordulia errans* (Calvert, 1909) (Goiás, São Paulo, Brasília, Mato Grosso?). Syn: *Dorocordulia errans* Calvert, 1909.

- There are three cells separating the anal loop and the wing margin for a distance of four to six cells with two cells separating them for the remainder of the distance. The setae at the apex of the abdomen do not extend far beyond the superior anal appendages (**Fig. 3.2.66**). Total length: c. 41.5 mm. Length of abdomen: c. 29 mm. Hind wing length: c. 28.8 mm.

.....*Navicordulia amazonica* Machado and Costa, 1995 (Mato Grosso).

Key to the species of adult *Santosia* in South America

Information for the key was provided by Costa and Santos (1992, 2000a).

1. The seventh through tenth abdominal segments are flattened. The superior anal appendages are about as long as the ninth and tenth abdominal segments, combined (**Fig. 3.2.28**). The frons and synthorax have only bluish reflections.

.....*Santosia marshalli* Costa and Santos, 1992 (Rio de Janeiro).

- The seventh through tenth abdominal segments are cylindrical. The superior anal appendages are slightly greater in length than the ninth and tenth abdominal segments, combined (**Fig. 3.2.67**). There are some green reflections from the frons and synthorax.2

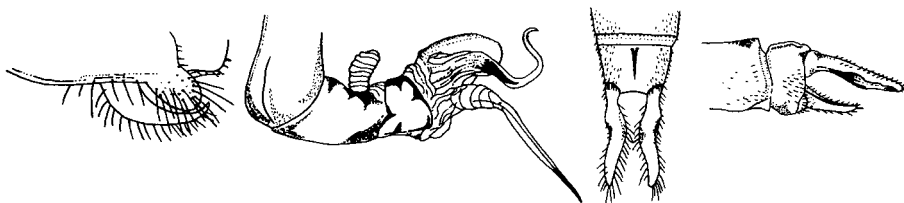


Fig. 3.2.67 *Santosia machadoi* male (left to right): genitalia on the second abdominal segment in lateral view, penis in lateral view, and the apex of the abdomen in dorsal and lateral view. Based on Costa and Santos (2000a).

2. The proximal, carinated part of the superior anal appendage is about as long as the distal section without a carina, and there is a large concavity on the ventrolateral side at the midlength. The carinated parts of the superior appendages are about equal in length to the inferior appendage (**Fig. 3.2.67**). Only greenish reflections are apparent on the frons and synthorax.

.....*Santosia machadoi* Costa and Santos, 2000 (São Paulo).

- The proximal, carinated part of the superior anal appendage is about as long as the distal section without a carina, and there is only a small concavity on the ventrolateral side at the midlength. The carinated parts of the superior appendages are clearly shorter than the inferior appendage (**Fig. 3.2.68**). Only bluish reflections are apparent on the frons, while the synthorax has both bluish and greenish reflections.

.....*Santosia newtoni* Costa and Santos, 2000 (Rio de Janeiro).

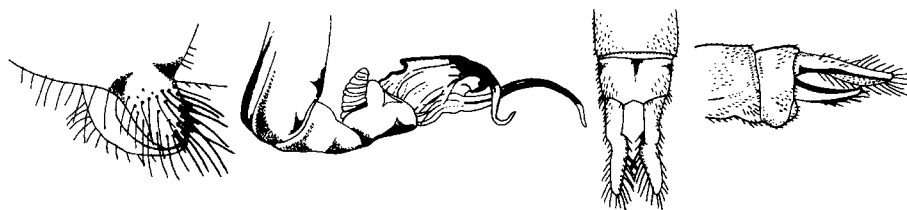


Fig. 3.2.68 *Santosia newtoni* male (left to right): genitalia on the second abdominal segment in lateral view, penis in lateral view, and the apex of the abdomen in dorsal and lateral view. Based on Costa and Santos (2000a).

Key to the species of known *Santosia* larvae in South America

Information for the key was provided by Costa and Santos (2000a). A description of the *Santosia marshalli* larva is not available.

1. There are 13 setae on the mentum. Each lateral lobe bears six setae. The epiproct and cerci are almost equally long and slightly shorter than the paraprocts (**Fig. 3.2.69**).

.....*Santosia newtoni* Costa and Santos, 2000
(Rio de Janeiro).

- There are 17 setae on the mentum. Each lateral lobe bears seven setae. The epiproct is obviously longer than the cerci and slightly shorter than the paraprocts (**Fig. 3.2.34**).

.....*Santosia machadoi* Costa and Santos, 2000
(São Paulo).

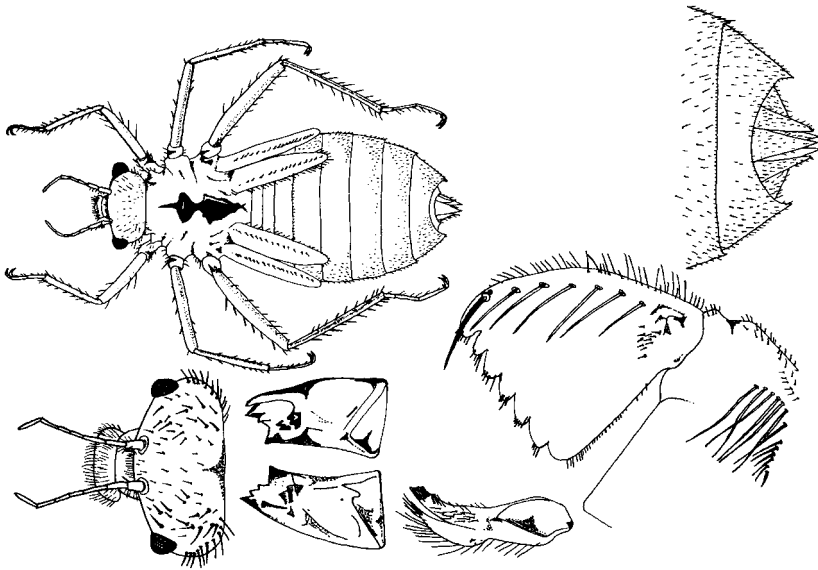


Fig. 3.2.69 *Santosia newtoni* larva: habitus of exuvia (upper left), head in dorsal view (lower left), mandibles (lower left center), maxilla (lower right center), labium (lower right), and the apex of the abdomen in dorsal view (upper right). Based on Costa and Santos (2000a).

Libellulidae

Key to the genera of adults in South America

Information for the key was provided by Ris (1911a, b), Borror (1945), Santos (1945a), Gloger (1962), Belle (1984a), and Westfall (1988). Ambiguities may require that both possibilities be checked to find a description that best fits a specimen. Only if both male and female specimens are available will the key function as intended. Difficulties may nevertheless arise because enough is not yet known about the degree of intraspecific variability in important characteristics, and some dragonfly specimens may have morphometric or meristic features that fall beyond the ranges previously reported for their genera.

1. In the hind wing, the anal loop is indistinct. The dorsal surface of the male head is shiny black, and the ventral parts are yellow. The thorax of the male is mainly dull yellow with oblique darker brown markings. The trochanters and bases of the femora are yellow, and the rest of the femora, tibiae, and tarsi are black. The wings are hyaline with black veins. The pterostigma of the male is black. The male abdomen is mainly black with the basal half of the second and the entire seventh abdominal segment yellow and yellow lateral markings on the third through sixth segments. The female has a long, canoe-shaped vulvar lamina, which extends from the eighth abdominal segment to well beyond the apex of the abdomen. The ninth abdominal segment of the female is not elongated, and the median gonapophyses are digitiform and well developed (**Fig. 3.2.70**). Total length: c. 29.5 mm. Abdomen length: c. 21 mm. Hind wing length: c. 22 mm. Length of pterostigma: c. 2.5 mm.

.....*Argyrothemis* Ris, 1911

The only known species in this genus is *Argyrothemis argentea* Ris, 1911 from Peru, Venezuela, Surinam, French Guiana, and Brazil.

- The anal loop is well developed, sac or foot shaped (**Fig. 3.2.71**).2

2. The costa of the fore-wing is somewhat sigmoid and has a concave indentation between the base and nodus, and the wings usually appear wrinkled and heavily darkened, brightly marked, or iridescent (**Fig. 3.2.72**).3

- The fore-wing lacks a concave indentation between the base and nodus (**Fig. 3.2.71**).4

3. The eyes are separated. The supratriangle is crossed (**Fig. 3.2.72**).

.....*Diastatops* Rambur, 1842..p. 141

- The eyes are contiguous. The supratriangle is usually free (**Fig. 3.2.73**).

.....*Zenithoptera* Selys, 1860..p. 147

4. The bisector of the anal loop in the hind wing is almost straight. The discoidal field of the fore-wing is never widened and usually narrowed distally. The wings are yellowish or amber, often partially hyaline, and with brown or black markings distal to the triangle. There are no more than 8½ antenodal cells in the fore-wing (**Fig. 3.2.71**). The hind wing length does not exceed 22 mm.

.....*Perithemis* Hagen, 1861..p. 148

- In the hind wing, the bisector of the anal loop is usually angulate beyond the middle. The wings are hyaline or only slightly tinged, without markings or with markings only apically, basally, or in the middle. If these black or reddish markings cover a considerable part of the wing, then the length of the hind wing is greater than 22 mm (**Fig. 3.2.74**).5

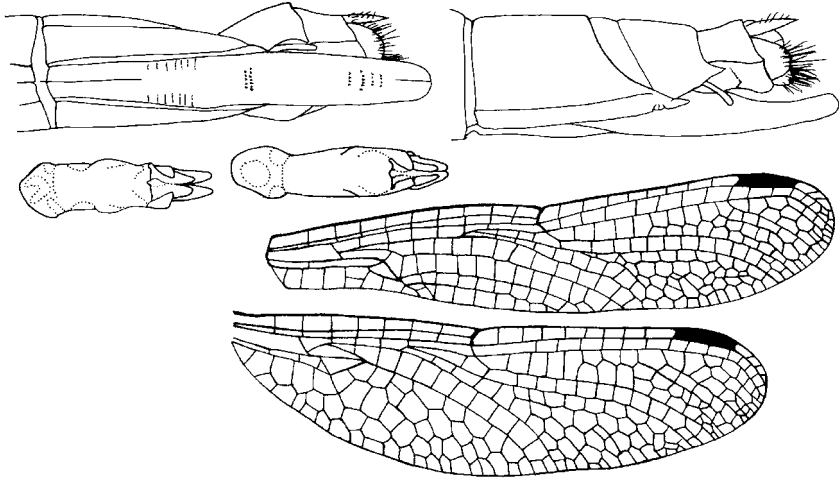


Fig. 3.2.70 *Argyrothemis argentea*: fore and hind wing of a male (below), apex of the female abdomen in ventral (upper left) and lateral view (upper right), and penes of two specimens in ventral view (below left and center). Based in part on Geijskes (1971) and DeMarmels (1989a).

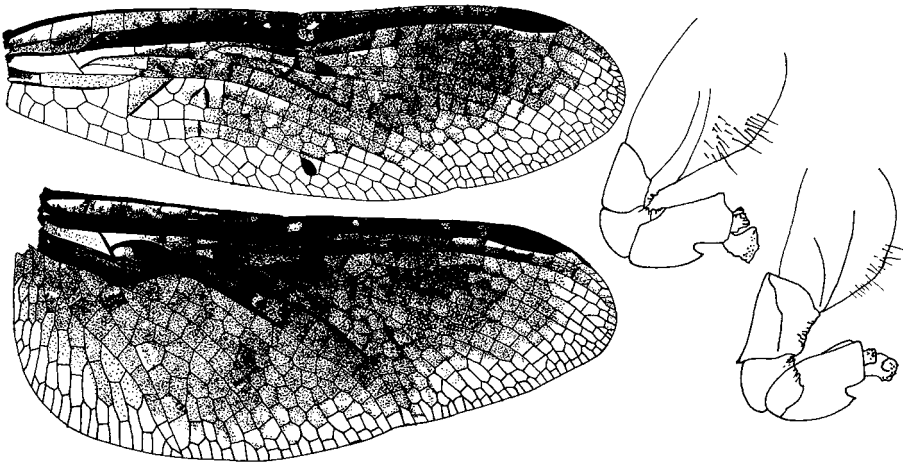


Fig. 3.2.71 Fore and hind wing of a female *Perithemis electra* (left) and the penes of two males in lateral view (center and right). Based on Ris (1930).

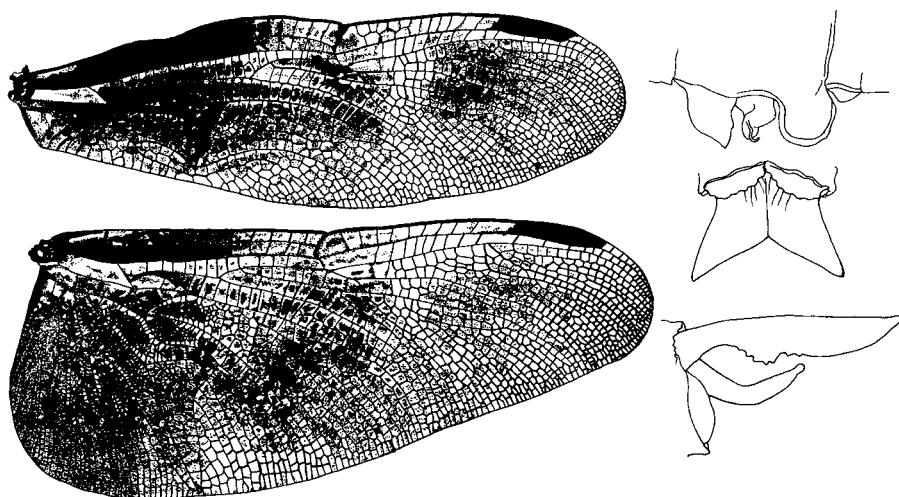


Fig. 3.2.72 *Diastatops intensa* male: fore and hind wing (left), and (right, top to bottom) the genitalia on the second abdominal segment in lateral view, the inferior anal appendage in ventral view, and the apex of the abdomen in lateral view. Based on Montgomery (1940).

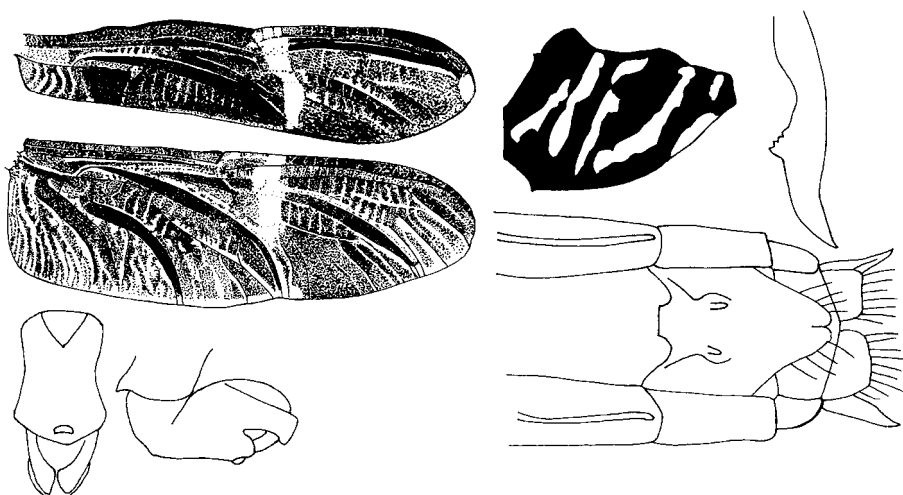


Fig. 3.2.73 *Zenithoptera fasciata*: fore and hind wings (upper left), color pattern on the lateral surface of the thorax (upper right center), penis in ventral (lower left) and lateral view (lower left center), superior anal appendage of a male in lateral view (upper right), and the apex of the abdomen of a female in ventral view (lower right). Based on Jurzitza (1982b).

5. The fore-wing has three or more cubito-anal crossveins, and two in the hind wing. There are one to three bridge cross veins. The triangles have two or more crossveins. The posterior lobe of the prothorax is very small, and its distal margin is weakly arched. The fore-wing has 20 or more antenodals, some irregular, and the arculus is between the first and second antenodal (Fig. 3.2.74). The hind wing is 47 mm and has a deep black basal spot extending halfway to the nodus.

.....*Antidythemis* Kirby, 1889..p. 159
 - There are fewer than three cubito-anal cross veins in the fore-wing and one or two in the hind wing, except in the genus *Uracis*. There are fewer than 20 antenodal veins in the fore-wing, except for some *Orthemis*. There are no more than 2 bridge cross veins (Fig. 3.2.75).6

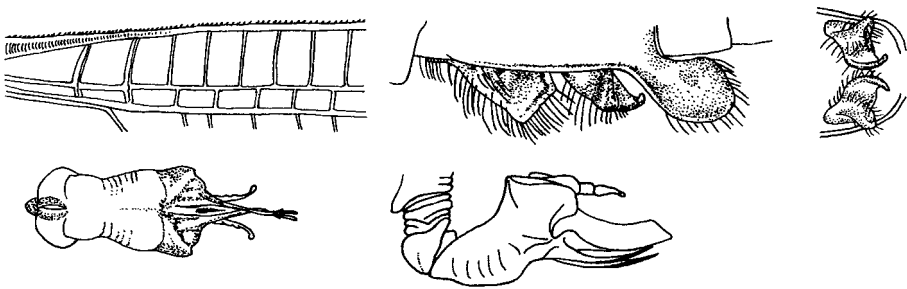


Fig. 3.2.74 *Antidythemis nigra* male (upper row, left to right): costal and subcostal fields at the base of the fore-wing showing the origin of the arculus between the first and second antenodal cross veins, genitalia on the second abdominal segment in lateral view, the hamuli in ventral view, and (lower row, left to right): the penis in ventral and lateral view. Based on Buchholz (1952).

6. The first three abdominal segments considerably widen laterally, have blister-like extensions, and are also expanded dorsovertrally. The fourth through tenth segments are elongated and have roughly parallel sides. The fore-wing has 12½ or more antenodal veins. The sectors of the arculus in the fore-wing are stalked. R₃ runs in the form of a single, moderately convex curve. There are two rows of cells in IR₃ - Rspl. Three discoidal cells border on the triangle. The discoidal area on the fore-wing is parallel-sided and moderately expanded toward the edge of the wing. The pterostigma is large (Fig. 3.2.75). Length of hind wing: 35 to 41 mm.

.....*Erythemis* Hagen, 1861 pars..p. 160
 South American species that might fit this description were formerly classified in the genus *Lepthemis* Hagen, 1861, but all of these have recently been transferred to the genus *Erythemis*. Elsewhere, the characters described here would be characteristic of *Lepthemis*.

- The first three abdominal segments are only moderately widened; in case of doubt, one or more of the other characters are not present (Fig. 3.2.76).7

7. The fore-wing has 14 or more antenodal cells, the last of which is complete. R_3 is obviously sinuous. There are two or three rows of cells in IR_3 -Rspl. Mspl is well developed. There are three or more discoidal cells bordering on the triangle (**Fig. 3.2.76**).8
- The last antenodal is not complete, or, if the last antenodal of the fore-wing is complete, then there are no more than 14 antenodals, or if there are more than 14 antenodals, then R_3 is not sinuous, there is one or more than three rows of cells in IR_3 -Rspl, or there are fewer than three discoidal cells bordering on the triangle. Fore-wing with sector stalked, usually 3 cell rows in the discoidal field, which is parallel sided or slightly narrowed distally, and usually 1 row between MA and Mspl (**Fig. 3.2.77**).9

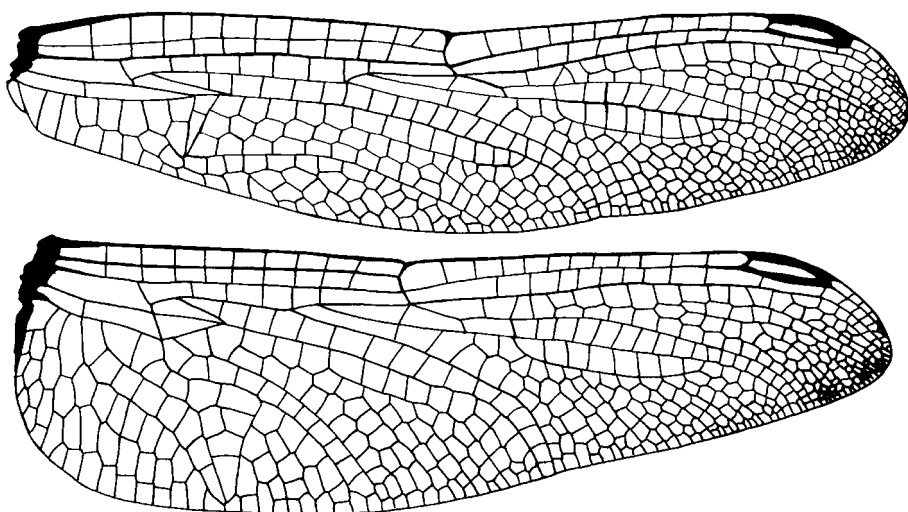


Fig. 3.2.75: Fore and hind wing of *Erythemis simplicicollis*. Based on Needhan and Westfall (1955).

8. The sectors of the arculus in the fore-wing are petiolate. The discoidal space is parallel-sided but widened near the edge of the wing through the pronounced curvature at the outermost ends of R_{4+5} and MA or only moderately widened. The hamulus consists of two parts. The eighth abdominal segment of the female is expanded laterally (**Fig. 3.2.76**).

.....*Orthemis* Hagen, 1861..p. 167

- The sectors of the arculus in the fore-wing are not stalked. There are four rows of cells in the discoidal field, which is widened distally, and two cell rows between MA and Mspl (**Fig. 3.2.78**).

.....*Libellula* Linnaeus, 1758..p. 180

9. There are two or more bridge cross veins. The sectors of the arculus in the fore-wing are stalked. There are never more than $12\frac{1}{2}$ antenodal cells (**Fig. 3.2.77**).10
 - There is no more than one bridge cross vein. (**Fig. 3.2.79**).13

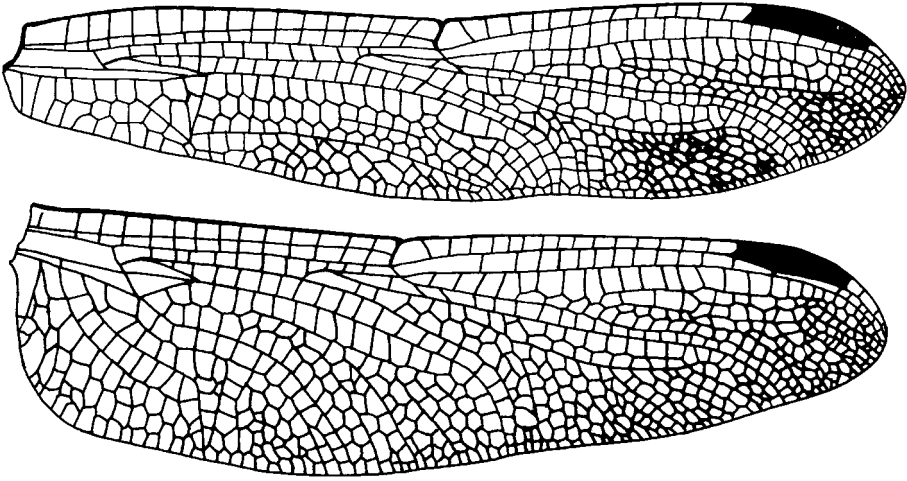


Fig. 3.2.76 Fore and hind wing of *Orthemis concolor*.

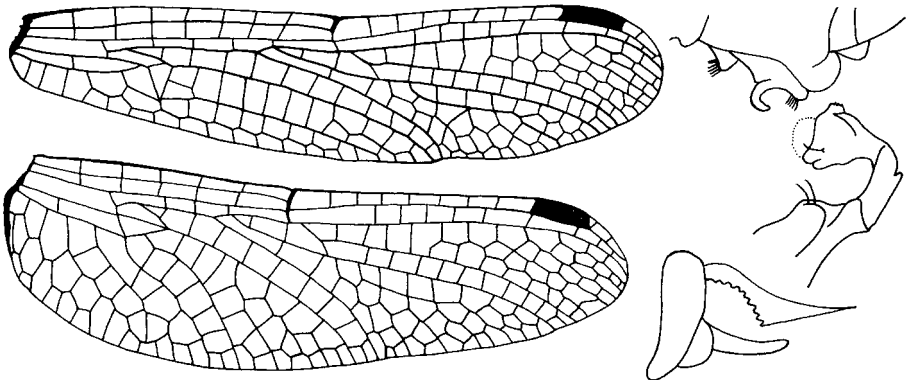


Fig. 3.2.77 *Nephepeltia leonardina*: fore and hind wing (left), lateral view of the ventral side of the second abdominal segment (upper right), penis in lateral view (middle right), and the apex of the abdomen in lateral view (lower right). Based on Rácenis (1953a).

10. The discoidal space in the fore-wing is only one row of cells thick for part of its length (**Fig. 3.2.77**).11
 - The discoidal space in the fore-wing is at least two cells wide for all of its length (**Fig. 3.2.80**).12

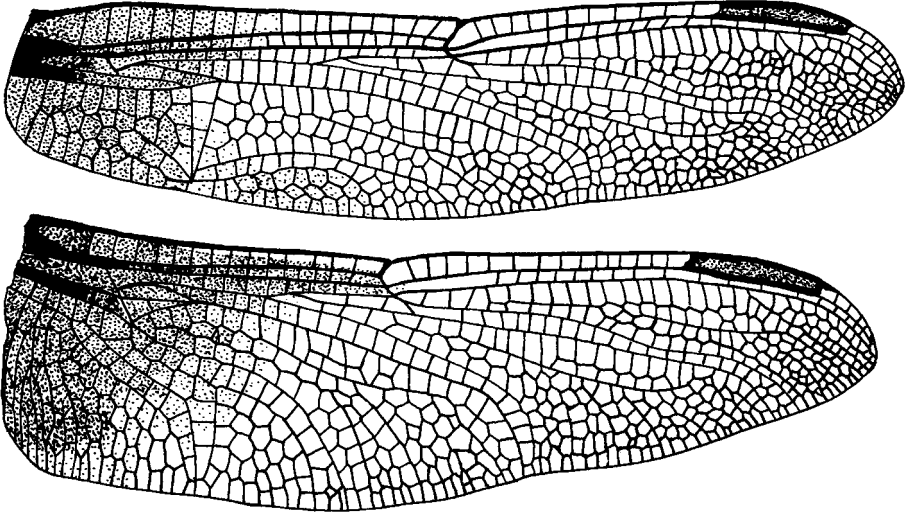


Fig. 3.2.78 Fore and hind wing of *Libellula croceipennis*.

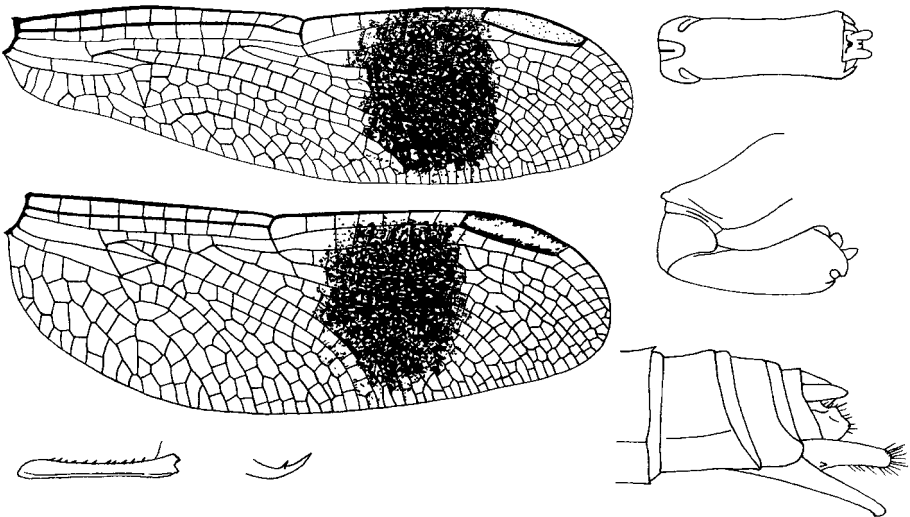


Fig. 3.2.79 *Ypirangathemis calverti*: fore and hind wing of a male (upper left), hind femur of a male in lateral view (lower left), claw on the fore-tarsus (lower center), penis in ventral (upper right) and lateral view (middle right), and apex of the female abdomen in lateral view (lower right). Based on Borror (1947).

11. The last antenodal cross vein in the fore-wing is complete (**Fig. 3.2.77**).

.....*Nephepeltia* Kirby, 1889..p. 180

- The last antenodal cross vein in the fore-wing is incomplete (**Fig. 3.2.81**).

.....*Fylgia* Kirby, 1889

This genus encompasses one species: *Fylgia amazonica* Kirby, 1889, from Ecuador, Peru, Venezuela, French Guiana, Guyana, Surinam, and Brazil. A second subspecies has been described: *Fylgia amazonica lychnitina* DeMarmels, 1989. The head of the male is brown with bright white spots on the dorsal surface of the compound eyes. The thorax is dark reddish brown with blackish dorsal markings. The abdomen is black at the base and ventrally but otherwise bright red, except for the brown anal appendages. The head and abdomen of the female are dark ocher yellow, and the thorax is darker yellow with a darker lateral stripe. The compound eyes of the female are dark reddish brown.

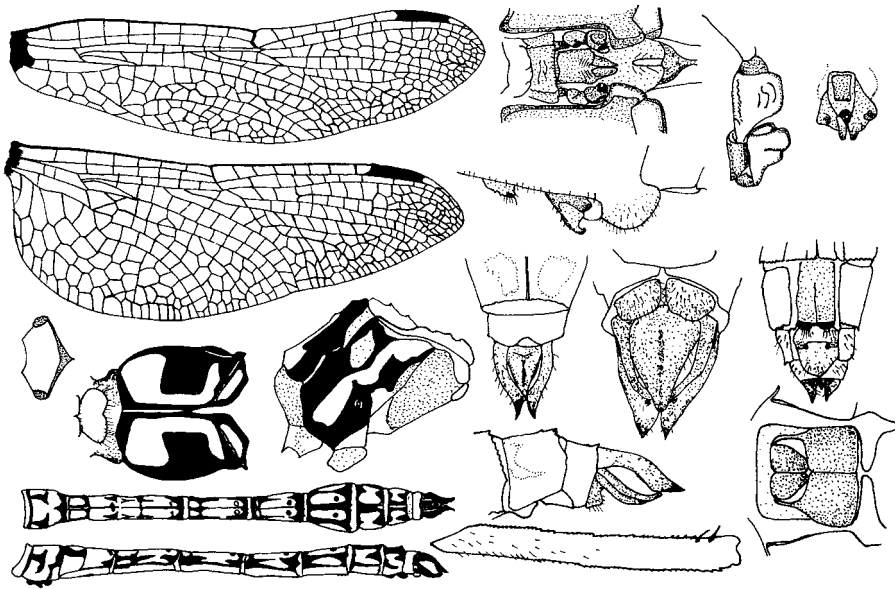


Fig. 3.2.80 *Micrathyria ringueleti* (upper row, left to right): fore and hind wing of a female, male genitalia on the second abdominal segment in ventral (above) and lateral view (below), penis in lateral and ventral view, and (middle row, left to right): vertex of the head in dorsal view, synthorax in dorsal and lateral view, apex of the abdomen of a male in dorsal and ventral view, apex of the female abdomen in ventral view, and (lower row, left to right): markings on the abdomen of a male in dorsal (above) and lateral view (below), apex of the male abdomen in lateral view (above), exterior surface of the hind femur (below), and the gonapophysis on the ventral side of the ninth abdominal segment of a female. Based on Rodrigues Capitúlo (1988).

12. The last antenodal cross vein in the fore-wing is complete (**Fig. 3.2.82**).

.....*Edonis* Needham, 1905

There is only one species, *Edonis helena* Needham, 1905, found in Argentina, São Paulo, and elsewhere in Brazil.

- The last antenodal cross vein in the fore-wing is incomplete (**Fig. 3.2.80**).

.....*Microthyria* Kirby, 1889..p. 183

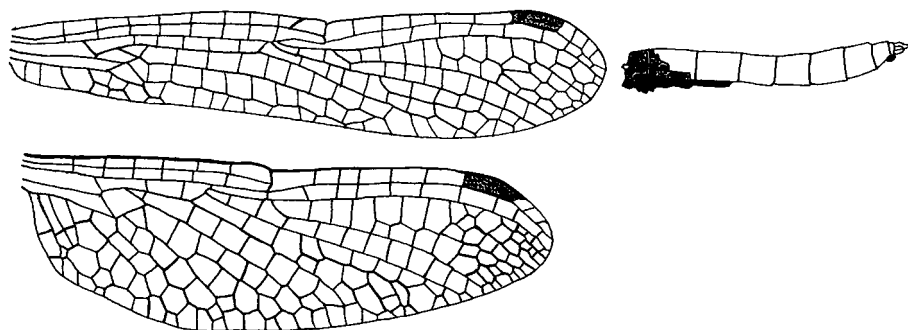


Fig. 3.2.81 *Fylgia amazonica* male: fore and hind wing (left) and the abdomen in lateral view, on which the light color is bright red and the dark color, black.

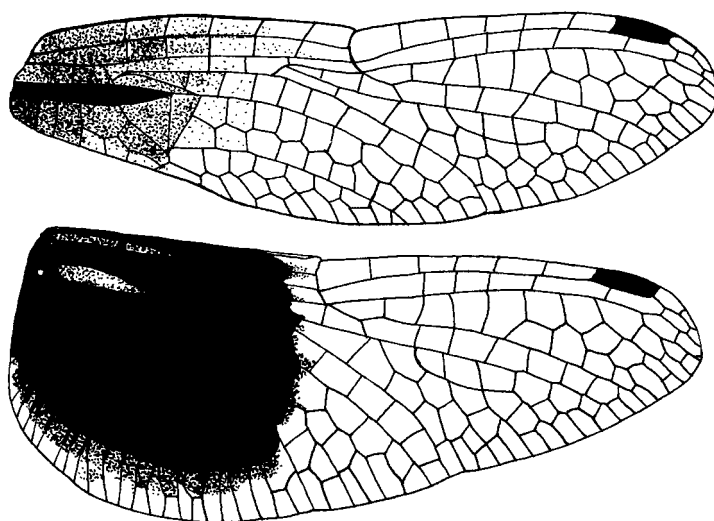


Fig. 3.2.82 Fore and hind wing of *Edonis helena*. Based on Ris (1919).

13. Females: the vulvar lamina and ninth sternite are very elongate, extending past the apex of the abdomen (**Fig. 3.2.79**). If the specimen is a male, check the descriptions in couplet 14, and if they do not match the specimen, go on to couplet 15.14
- Females: the vulvar lamina and ninth sternite are not very elongate and do not extend past the end of the abdomen (**Figs. 3.2.80, 3.2.83**).15

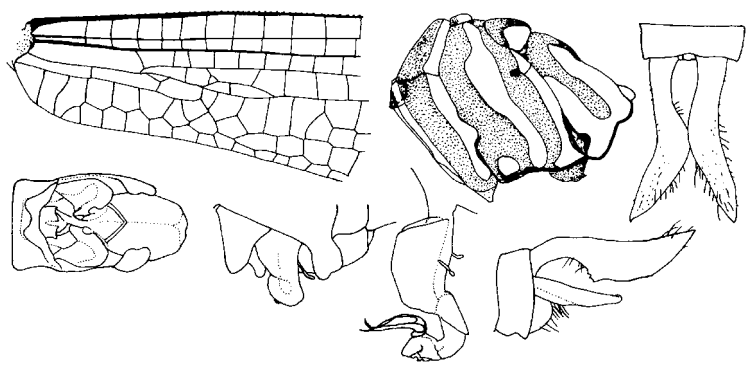


Fig. 3.2.83 *Misagria divergens* male (upper row, left to right): veins in the basal portion of the fore-wing, diagram of the color pattern on the pterothorax, dorsal view of the apex of the abdomen, and (lower row, left to right): genitalia on the second abdominal segment in ventral and lateral view, lateral view of the penis, and the apex of the abdomen in lateral view. Based on DeMarmels (1981a).

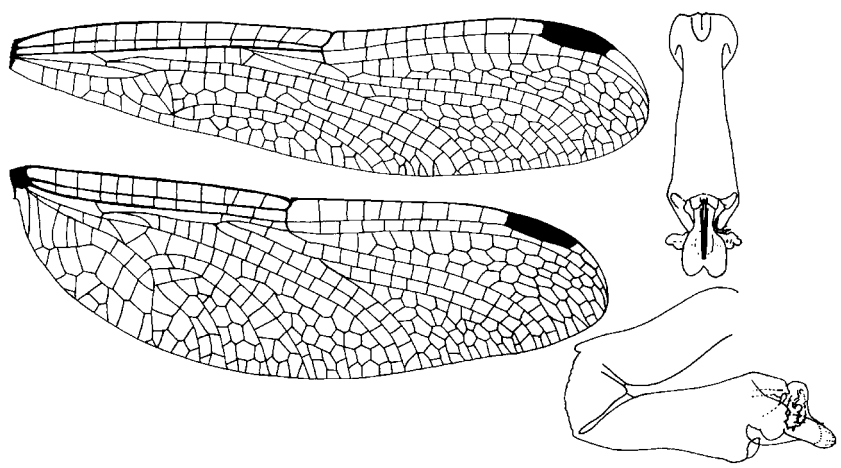


Fig. 3.2.84 *Uracis siemensii*: fore and hind wing (left) and the penis in ventral (upper right) and lateral view (lower right). Based on Kirby (1897) and Borror (1947).

14. Arc in the fore-wing is between the second and third antenodals. Cu_2 in the hind wing borders on the anal angle of the triangle. The base of the triangle is distal to Arc. The fore-wing does not have less than $10\frac{1}{2}$ antenodal cross veins and usually has more; the last antenodal vein is incomplete. There are at least two transversal veins in Cu-a of the hind wing. The triangle of the hind wing is crossed, or, if not, then the triangle of the fore-wing is in an oblique position, forming a right angle where it intersects the supratrangular vein. There is only one row IR3-Rspl. Vein Msp1 is absent. The discoidal space in the fore-wing is narrowed in the middle and expanded strongly near the edge (**Fig. 3.2.84**).

.....*Uracis* Rambur, 1842..p. 221

- Arc in the fore-wing is nearest the level of the second antenodal cross vein. Cu_2 in the hind wing is sometimes separated from the anal angle of the triangle. The base of the triangle is located along Arc. The fore-wing usually has more than $10\frac{1}{2}$ antenodals, the last of which is incomplete. The distance between the first and second antenodal is not increased. There is one transversal vein in Cu-a of the hind wing. The discoidal space in the fore-wing is narrowed in the middle and expanded strongly near the edge. There are only two rows of cells between A_3 and the edge of the anal space of the hind wing. The hamule of the male is forked; its exterior branch is enlarged (**Fig. 3.2.79**). The only known species is characterized by hyaline wings with a large dark spot in the middle of the apical half.

.....*Ypirangathemis* Santos, 1945

The only species in this genus is *Ypirangathemis calverti* Santos, 1945, known from Venezuela and Brazil, as far south as São Paulo. The color is largely black or bluish black with metallic blue on the face and a narrow yellowish dorsal stripe on the prothorax, yellowish brown synthorax, and brown stripe on the abdomen. The hind wing is about 22 mm long, and the abdomen of the female is about 18 mm.

15. The fore-wing has 16 or more antenodal cross veins, the last of which is complete. The triangles are crossed in both wings (**Fig. 3.2.83**).

.....*Misagria* Kirby, 1889..p. 224

- There are fewer than 16 antenodal cross veins in for fore-wing, or, if there are 16 or more, then the last one is incomplete (**Fig. 3.2.85**).16

16. There are more than 12 antenodals in the fore-wing, and the last of them is complete. Arc is between the second and third antenodals. There are two transverse Cu-a veins in the hind wing. The triangle of the fore-wing is crossed. Vein R_3 is only slightly sinuous. Cu_2 is widely separated from the anal angle of the triangle in the hind wing. The discoidal space of the fore-wing is somewhat narrowed and scarcely widened near the edge of the wing (**Fig. 3.2.85**).

.....*Cannaphila* Kirby, 1889

Only one species has been found in South America: *Cannaphila vibex* (Hagen, 1861), with synonyms *Libellula vibex* Hagen, 1861; and *Libellula merida* Selys, 1868, from Central America, Colombia, Ecuador, Peru, Venezuela, Bolivia, Argentina, and Brazil. Caution: exceptional specimens of male *Elasmothemis*

alcebiadesi and *Dythemis maya* may key out here. See the keys to *Elasmothemis* on p. 371 and *Dythemis* on p. 374 for the characteristics of these species.

- If there are more than 12 antenodal cross veins in the fore-wing, then the last of them is incomplete, or, if this is not the case, then there is only one transverse vein, Cu-a, in the hind wing (**Fig. 3.2.86**).17

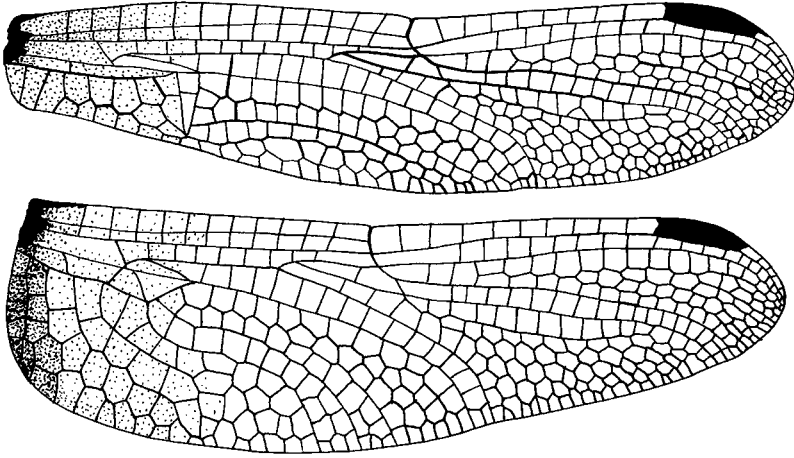


Fig. 3.2.85 Fore and hind wing of *Cannaphila vibex*. Based on Ris (1910).

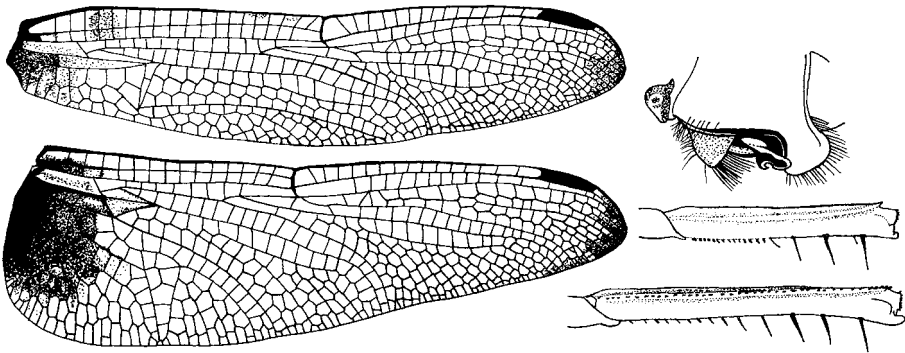


Fig. 3.2.86 *Rhodopygia cardinalis*: fore and hind wing (left), male genitalia on the second segment of the abdomen in lateral view (upper right), middle and hind femora (middle and lower right, respectively). Based on Ris (1911b) and Buchhotz (1953).

17. Red or reddish brown dragonflies with at least 15 1/2 antenodals in the forewing. R_3 arcs in a simple, moderately convex curve. The posterior lobe of the prothorax is large, narrowed at the base, erect, and bears a fringe of long hairs. The middle femur of the male bears short, stout, and blunt-tipped spines on the basal 2/3 that are relatively uniform in length. The spines on the distal third of this femur are long and thin. The hind femur of the male bears very short spines on the basal half of the outer angle and long and slender ones on the distal half (Fig. 3.2.86). Length of hind wing: 35 to 40 mm.

.....*Rhodopygia* Kirby, 1889..p. 227
 - If the dragonflies are predominantly red or brownish red, then there are not more than 10 antenodal cross veins in the fore-wing, vein R_3 is somewhat sinuous, the posterior lobe of the prothorax is very small and not narrowed at the base, or the length of the hind wing is less than 35 mm (Fig. 3.2.87).18

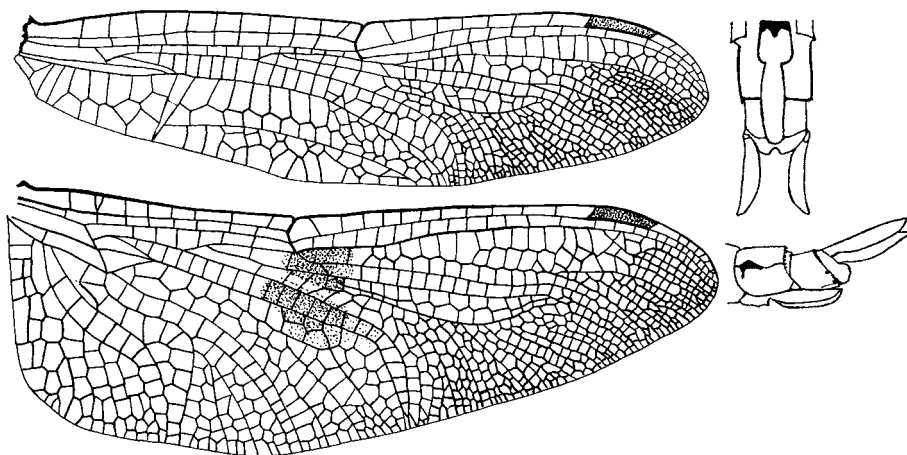


Fig. 3.2.87 *Tholymis citrina*: fore and hind wing (left) and apex of the female abdomen in ventral (upper right) and lateral view (lower right). Based in part on Needham and Westfall (1955).

18. The anal loop is generally open posteriorly and extends to the edge of the wing. The posterior lobe of the prothorax is very small. The fourth segment of the abdomen has a transverse carena. The external branch of the hamule of the male is exposed. The eighth sternite of the female is elongated to form a vulvar lamina that is very wide but scarcely elevated from the plane of the sternites; it is forked almost at the base to form two triangular processes that are acutely pointed at the tips. The ninth sternite is elongated horizontally to form a tongue-like extension reaching the posterior edge of the tenth sternite and forked dorsally and rounded at its tips. Vein R_3 is moderately sinuous. There are two rows of cells between IR_3 and $Rspl$. Three cells in the discal space border on the

triangle of the fore-wing, which reaches the edge of the wing (**Fig. 3.2.87**). Length of the hind wing: 35 to 40 mm.

.....*Tholymis* Hagen, 1867

There is a single species in this genus: *Tholymis citrina* Hagen, 1867, known from Mexico, Central America, the West Indies, Colombia, Ecuador, Peru, Venezuela, Guyana, French Guiana, Chile, Argentina, Paraguay, Mato Grosso do Sul, and Mato Grosso. Male chromosome number: $2n = 25$, $n = 13$ (Ferreira *et al.*, 1979).

- The anal loop is closed. If not, then the hind wing is shorter than 35 mm or other features of the above description are not present (**Fig. 3.2.88**).19

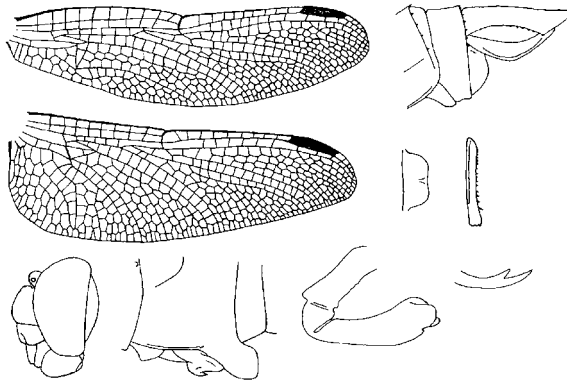


Fig. 3.2.88 *Erythrodiplax transversa* (male): fore and hind wing (upper left), head in lateral view (lower left), lateral view of genitalia on the second abdominal segment (lower left center), penis in lateral view (lower right center), apex of the abdomen (upper right), posterior lobe of the prothorax (right of hind wing), hind femur (middle right), tarsal claw on the hind leg (lower right). Based on Borror (1957).

19. On the lateral surface of the second abdominal segment, there is a supplementary transverse carina. The membranule is brown or black. The posterior lobe of the prothorax is usually small, flat or only slightly raised, and bordered by an evenly curving posterior edge with a slight indentation at the mid-line; in rare cases, it may be somewhat larger, more raised, and divided in the middle. The apical tarsal segment is moderately long and thin. The hind femora have short spines, the spaces between them being clearly longer than one spine. The second and third abdominal segments each bear a transverse carina. The sectors of the arculus are petiolate, somewhat less in the fore than the hind wing. The arculus is not enlarged between the first and second antenodals. There are no more than 16 antenodals in the anterior wing. Cu_2 is strongly convex in the fore-wing, and the discoidal space broadens in the middle and is very wide at

the edge of the wing. There are not more than three cells bordering on the triangle. The pterostigma is usually very large. The inner branch of the hamule of the male is much smaller than the outer branch; it projects ventromesad and is scarcely visible in lateral view. The vulvar lamina of the female is well developed and scoop-shaped, 1/4 as long as the ninth segment, and projecting ventrad. The tenth segment of the female is not elongated distad on the ventral side (**Fig. 3.2.88**). Length of hind wing: not more than 35 mm.

.....*Erythrodiplax* Brauer, 1868..p. 230
 - One or more of the characters in the above description is absent. 20
 20. There are no more than 10 antenodals in the fore-wing and one row of cells between IR₃ - Rspl. The triangles are free. Mspl is absent. Cu₂ is separated from the anal angle of the triangle in the hind wing. There are no more than two discoidal cells bordering on the triangle in the fore-wing. The discoidal space is moderately expanded at the edge of the wing (**Fig. 3.2.89**). The posterior lobe of the prothorax is large, erect, and armed with fine bristles. 21
 - One or more of the characters in the above description is absent. 22

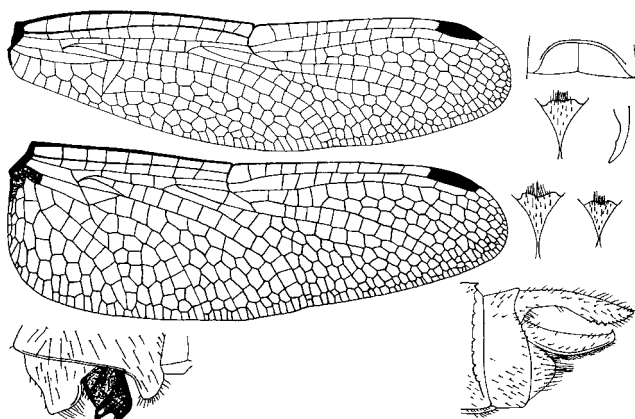


Fig. 3.2.89 *Oligoclada abbreviata abbreviata*: fore and hind wing of a male (upper left), tarsal claw (upper middle right), occipital part of the head of a male (left of claw) and of two different female specimens (lower middle right), male genitalia on the second abdominal segment in lateral view (lower left), apex of the male abdomen in lateral view (lower right), and female vulvar lamina (upper right). Based on Borror (1931).

21. The last tarsal segment is short and robust. The hind femora of the males bear spines with moderate distances separating them; near the apex, they are short, but the last spine is large. The middle femur is considerably elongated. There are numerous long, thin spines on the tibia. The claws are short, strongly curved, and without teeth or only with a tiny denticle near the tip. The external branch of the hamule is not developed. The arculus is located at the second

antenodal cross vein or sometimes slightly distal to it. In the fore-wing, the triangle, subtriangle, and supratriangle are free. R_3 is sometimes curved. The borders of the discoidal space run parallel, and the space usually borders the triangle with two cells, one of which may be incomplete (**Fig. 3.2.90**).

.....*Elga* Ris, 1911..p.289
 - The last tarsal segment is long and thin. The arculus is located between the first and a point just distal to the second antenodal cross vein. R_3 is moderately curved. The discoidal space has one or two rows of cells, and it is moderately widened near the border of the wing. The claws are long, very thin, sometimes with a sharply pointed tooth near the middle or the apex. The fourth abdominal segment often has a transverse carina, especially notable in the female (**Fig. 3.2.89**).

.....*Oligoclada* Karsch, 1889..p. 290
 22. Cu_2 in the hind wing is separated from the anal angle of the triangle. The sectors of the arculus are obviously petiolate. Vein R_3 is straight or curved in only one direction. There is only one row of cells $IR_3 - Rspl$ in the fore-wing. The discoidal space is not expanded near the margin of the wing (**Fig. 3.2.91**).

.....23
 - Cu_2 reaches the anal angle of the triangle in the hind wing (**Fig. 3.2.92**).25

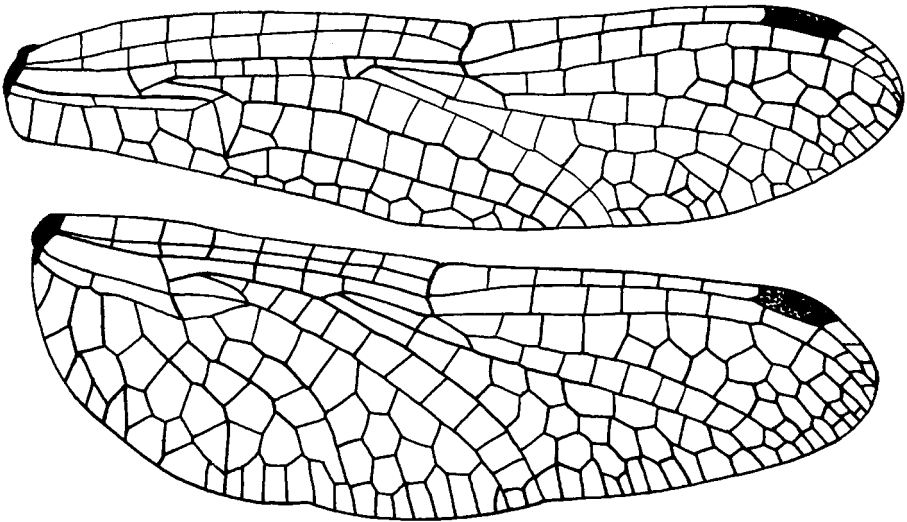


Fig. 3.2.90 Fore and hind wing of *Elga leptostyla*.

23. The last antenodal in the fore-wing is complete. The posterior lobe of the prothorax is small. Not more than two cells border on the triangle in the discoidal space of the fore-wing. $Mspl$ is absent. The pterostigma is moderately large (**Fig. 3.2.91**).

.....*Dasythemis* Karsch, 1889..p. 307
 - The last antenodal of the fore-wing is incomplete (**Fig. 3.2.93**).24

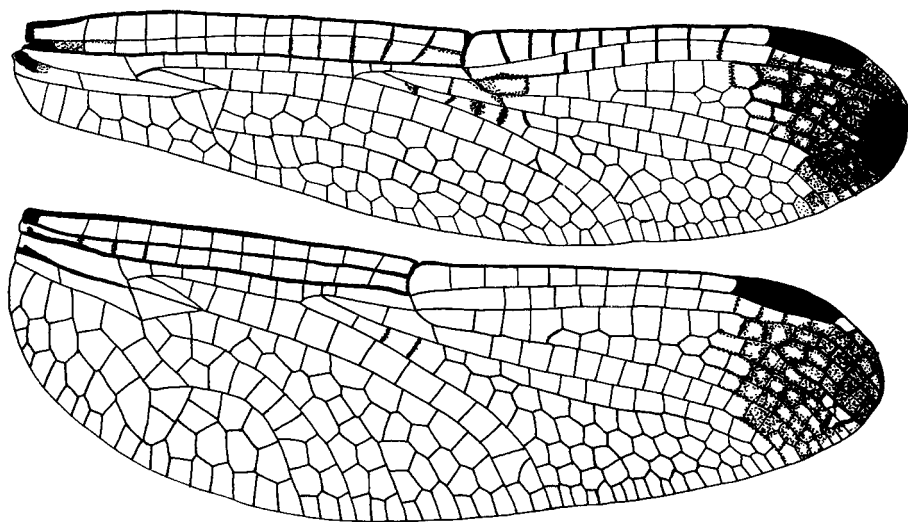


Fig. 3.2.91 Fore and hind wing of *Dasythemis venosa*. Based on Ris (1910).

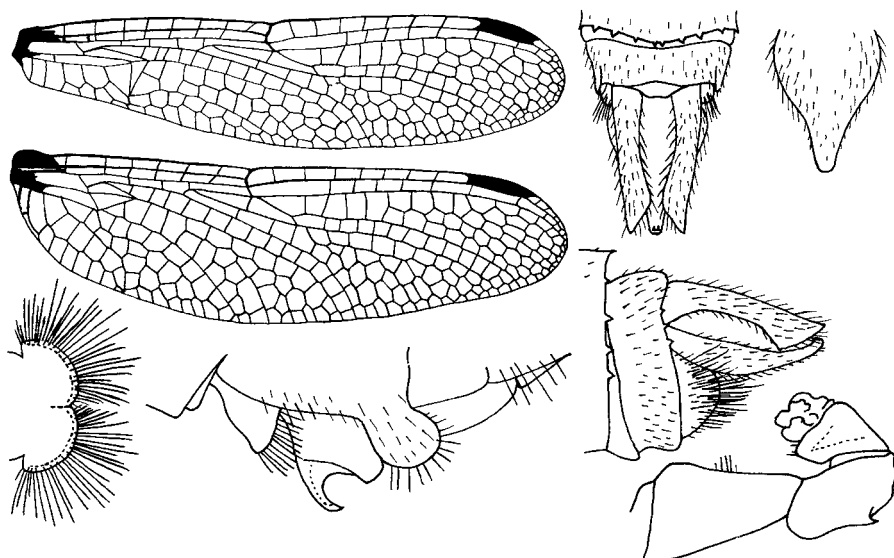


Fig. 3.2.92 *Nothodiplax dendrophila* male: fore and hind wing (upper left), anterodorsal view of the posterior lobe of the prothorax (lower left), genitalia on the second abdominal segment (lower left center), penis in lateral view (lower right), apex of the abdomen in dorsal (upper right center) and lateral view (middle right), and the inferior anal appendage in ventral view (upper right). Based on Belle (1984a).

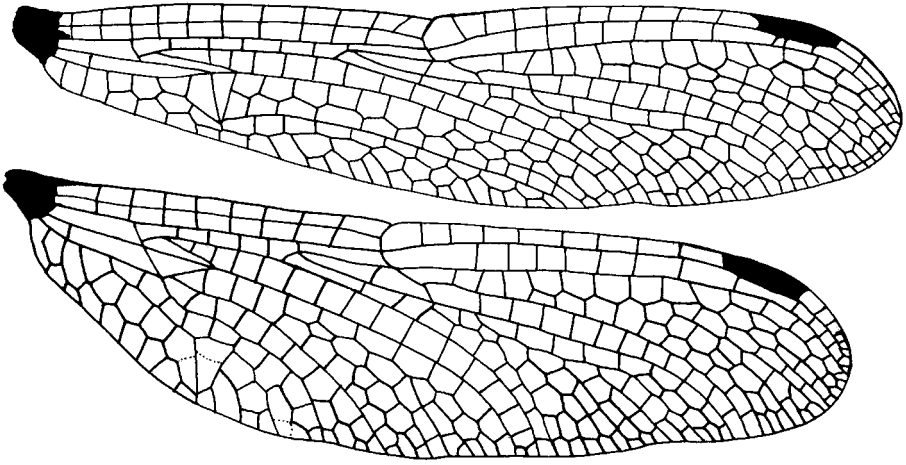


Fig. 3.2.93 Fore and hind wing of *Anatyia normalis*. Based on Ris (1911a).

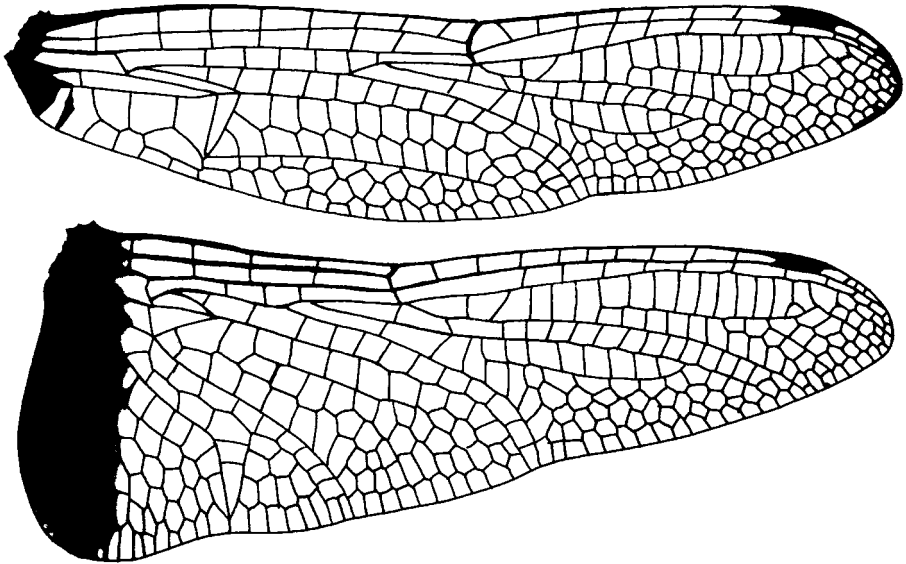


Fig. 3.2.94 Fore and hind wing of *Miathyria marcella*. Based on Needham *et al.* (2000).

24. The triangle of the fore-wing is free. Not more than two cells border the triangle in the discoidal space of the fore-wing. Msp1 is absent. The pterostigma is moderately large (**Fig. 3.2.93**). Length of the hind wing: not more than 30 mm.

.....*Anatya* Kirby, 1889..p. 310
 - The triangle of the fore-wing is crossed. There are two or three cells bordering on the triangle in the discoidal space of the fore-wing. The pterostigma is usually large. The posterior lobe of the prothorax is large and usually bears long hair-like setae (**Fig. 3.2.75**).

.....*Erythemis* Hagen, 1861 pars..p. 160
 25. The posterior lobe of the thorax is large, erect, and bears long hairs (**Fig. 3.2.92**).26

- The posterior lobe of the prothorax is small (**Fig. 3.2.94**).30

26. The sectors of the arculus are obviously petiolate. There are no more than 10 1/2 antenodal cross veins in the fore-wing, the last of which is incomplete. The triangle of the fore-wing is crossed. The posterior lobe of the prothorax is narrow at its base, and it is usually erect and fringed with long hair-like setae (**Fig. 3.2.92**).27

- The sectors of the arculus are not petiolate (**Fig. 3.2.95**).29

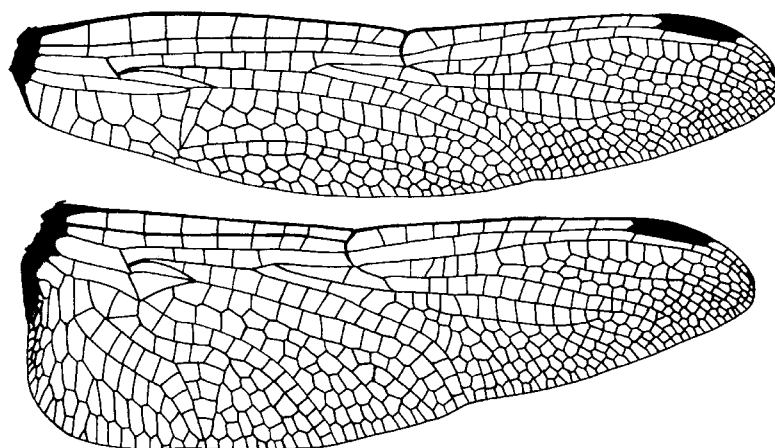


Fig. 3.2.95 Fore and hind wing of *Brachymesia furcata*. Based on Needham *et al.* (2000).

27. The fourth abdominal segment of the female, and sometimes the male, has a transverse carina. There are no more than 9 1/2 antenodal cross veins in the fore-wing, the last of which is incomplete. One cross vein arises along the posterior border of the pterostigma. The base of the triangle of the hind wing is located at the arculus. R_3 is somewhat curved or almost straight. Three or four cells of the discoidal space border on the triangle; the space is not widened near the edge of

the wing. The loop has an additional cell at the anal angle of the triangle. The external branch of the hamule in the male is well developed.

.....*Tarnetrum* Needham and Fisher, 1936

This has frequently been treated as a subspecies of *Sympetrum*, and no South American species are currently assigned to this genus.

- There is no transverse carina on the fourth abdominal segment (**Fig. 3.2.92**).

.....28

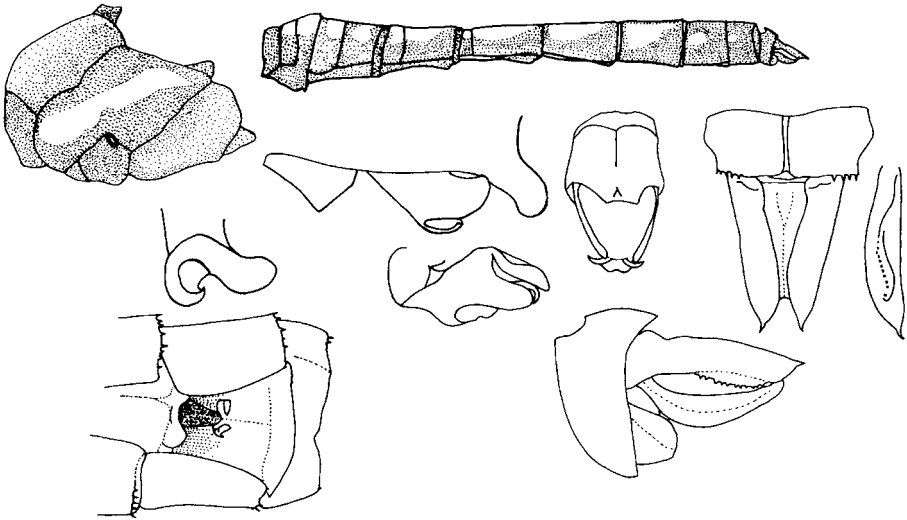


Fig. 3.2.96 *Sympetrum paramo*: dark brown and white pattern on the lateral surface of the pterothorax (upper left), dark brown and ochre pattern on the abdomen of a male in lateral view (upper right), lateral view of the male genitalia on the second abdominal segment (left of center) above the hamulus in lateroventral view (left) and the apex of the penis in lateral view (right), penis in ventral view (right of center), apex of the male abdomen in dorsal view with a ventral view of a superior anal appendage in ventral view to its right (middle right), lateral view of the apex of the male abdomen (lower right), and a ventral view of the eighth segment of the female abdomen showing the vulvar scale (lower left). Based on DeMarmels (2001).

28. Two cross veins arise along the posterior border of the pterostigma. There is a supplementary transverse carina on the third abdominal segment but not on the second or fourth. The spines on the hind femur are short in the basal half and then increase in size toward the apex. There is a distinct tooth 2/3 of the way from the base to the apex of each tarsal claw. The membranule is white. The paraptera are rounded. There is a single tooth on the ventral side of the superior

anal appendage of the male (**Fig. 3.2.92**). The vulvar lamina is short and inconspicuous; it has a broad, shallow median excision.

.....*Nothodiplax* Belle, 1984

The only known species in this genus is *Nothodiplax dendrophila* Belle, 1984, from Surinam and French Guiana. It is a brown species with light brown markings and a whitish yellow labium. Its total length is about 31 to 32.5 mm, including an abdomen about 21 to 22.5 mm long. The hind wing length is about 24.5 mm, and the costal border of the pterostigma in the fore-wing is about 2.3 to 2.4 mm.

- One cross vein arises along the posterior border of the pterostigma (**Fig. 3.2.96**).

.....*Sympetrum* Newman, 1833..p. 312

29. There are 8 to 11 antenodal cross veins in the fore-wing, which has a triangle located in a position distal to that of the triangle in the hind wing. R_3 is moderately convex and not sinuous. There is one row of IR_3 - $Rspl$ cells, or some of the cells are doubled. Two to four cells border on the triangle in the discoidal space of the fore-wing. There are no additional cells in the loop at the anal angle of the triangle. There are numerous cells in the anal space. The pterostigma is moderate in size. The abdomen of the male is short and robust but narrowed at the base. The external branch of the hamule of the male is not well developed and consists only of a vestige (**Fig. 3.2.97**). Length of the hind wing: at least 26 mm.

.....*Planiplax* Muttkowski, 1910..p. 318

- There are $8\frac{1}{2}$ to $11\frac{1}{2}$ antenodal cross veins in the fore-wing, the last of which is always incomplete. The triangle is in the same position in both wings. Three cells border on the triangle in the discoidal space of the fore-wing, the sectors of which are parallel or sometimes expanded near the edge of the wing. There are three to four rows of cells in the anal space of the hind wing. The pterostigma is moderate in size (**Fig. 3.2.95**). The abdomen is very much narrowed at the base and then broadened strongly at about the third segment. An external branch of the hamule is present in the male. Length of the hind wing: at least 32 mm.

.....*Brachymesia* Kirby, 1889..p. 321

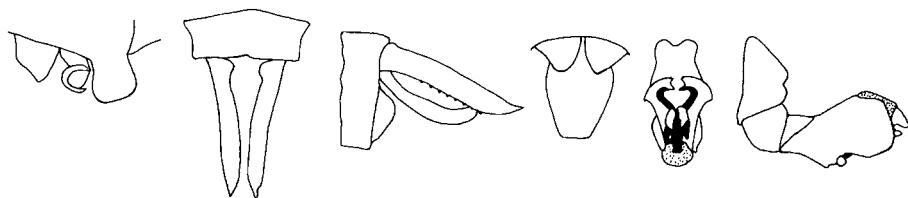


Fig. 3.2.97 *Planiplax erythropyga* male (left to right): genitalia on the second abdominal segment in lateral view, superior anal appendages in dorsal view, apex of the abdomen in lateral view, ventral anal appendage in ventral view, and penis in ventral and lateral view. Based on Santos (1949a).

30. No more than two cells border on the triangle in the discoidal space of the fore-wing (**Fig. 3.2.94**).31
 - Three or more cells border on the triangle in the discoidal space of the fore-wing. The triangle of the fore-wing is generally crossed. There are one or two rows of IR₃ - Rspl cells (**Fig. 3.2.98**).36

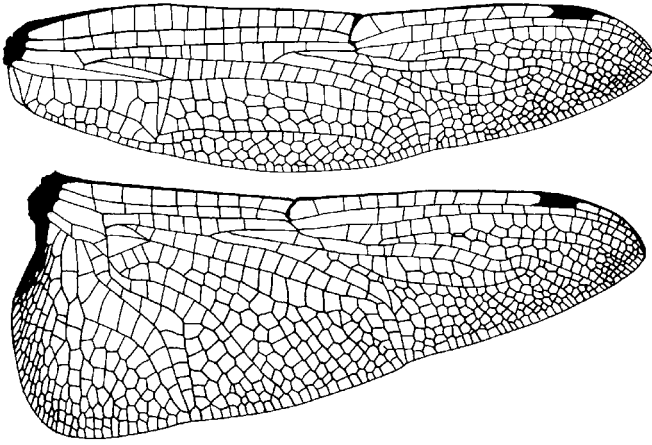


Fig. 3.2.98 Fore and hind wing of *Pantala flavescens*. Based on Needham and Westfall (1955).

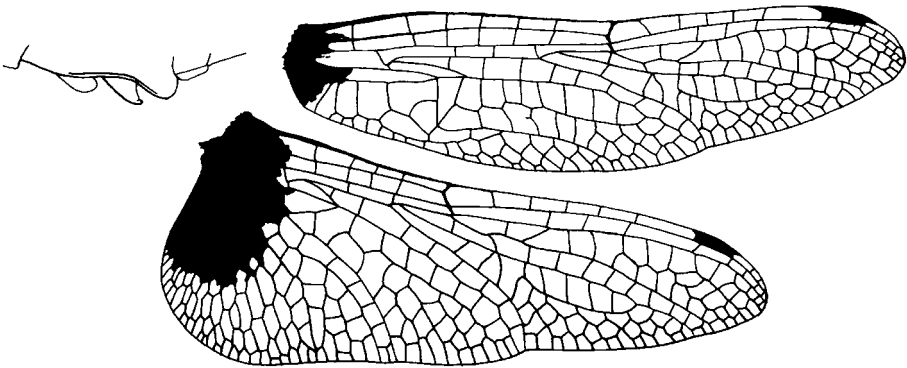


Fig. 3.2.99 *Macrodiplax balteata*: fore and hind wing (right) and male genitalia on the second abdominal segment in lateral view (left). Based on Needham and Westfall (1955) and Rácenis (1953b).

31. There are six or seven antenodals in the fore-wing, the distalmost of which is complete. The genital lobe of the male is simple and broadly-rounded, and it does not extend ventrad quite as far as the hamulus (**Fig. 3.2.99**).

.....*Macrodiplax* Brauer, 1868

The only species in this genus is *Macrodiplax balteata* (Hagen, 1861), known from Central America, the West Indies, and Venezuela, where it may inhabit brackish water (Dunson, 1980). It is also known by its synonym: *Tetragoneuria balteata* Hagen, 1861.

- The last antenodal in the fore wing is incomplete (**Fig. 3.2.94**).32

32. There are not more than $8\frac{1}{2}$ antenodals in the fore-wing (**Fig. 3.2.94**).33

- There are more than $8\frac{1}{2}$ antenodals in the fore-wing (**Fig. 3.2.100**).34

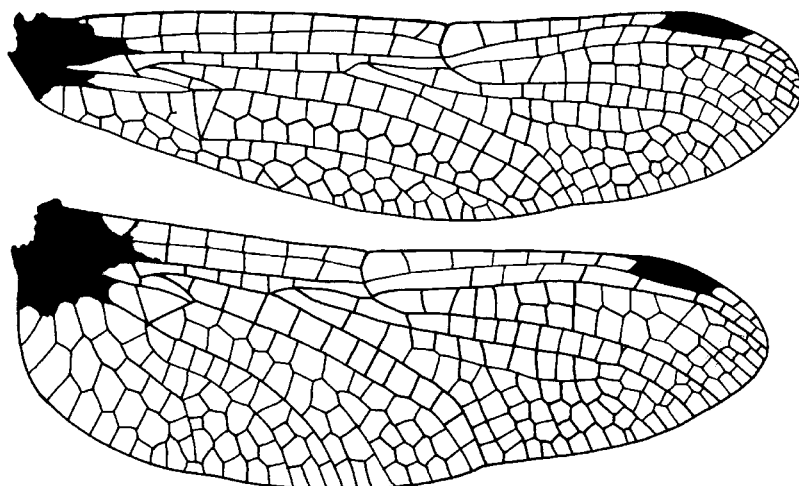


Fig. 3.2.100 Fore and hind wing of *Gynothemis heteronycha*. Based on Ris (1913).

33. The costal border of the triangle in the fore-wing is somewhat shorter than half the length of the proximal border. The location of the triangle in the fore-wing is somewhat more than two cells more distal than the triangle in the hind wing. The pterostigma is small, somewhat smaller in the hind than the fore-wing (**Fig. 3.2.94**).

.....*Miathyria* Kirby, 1889..p. 321

- The costal border of the triangle in the fore-wing is longer than half the length of the proximal border. The location of the triangle in the fore-wing is one cell or somewhat more distal than the triangle in the hind wing. The pterostigma is moderately large and the similar in both wings (**Fig. 3.2.101**).

.....*Idiataphe* Cowley, 1934..p. 323

34. Vein R_3 is strongly or moderately sinuous. The discoidal space in the fore-wing is strongly expanded near the edge of the wing. There are $11\frac{1}{2}$ to $14\frac{1}{2}$ antenodal cross veins in the fore-wing. The triangle is almost always crossed.

Mspl is developed on both wings in most species. The tooth on the tarsal claws is moderately large with a wide base but narrowing toward the apex. (**Fig. 3.2.102**). Length of hind wing: usually more than 28 mm. The means of distinguishing this genus from *Macrothemis* are not reliable for all species.

.....*Brechmorhoga* Kirby, 1894 pars..p. 325
 - Vein R_3 is moderately concave or straight. Mspl is absent from the discoidal space in the fore-wing (**Fig. 3.2.100**).35

35. The discoidal space in the hind wing is parallel-sided or slightly expanded near the apex. There are $9\frac{1}{2}$ to $11\frac{1}{2}$ antenodals. The triangle in the fore-wing is free. The tarsal claw is very long and straight; its tooth ends far proximal to the tip and is sometimes only half the length of the claw (**Fig. 3.2.100**).

.....*Gynothemis* Calvert, 1909..p. 334
 - The discoidal space in the hind wing is scarcely widened near the edge of the wing. There are $10\frac{1}{2}$ to $15\frac{1}{2}$ antenodals. The triangle in the fore-wing is free. The tarsal tooth is usually as long or longer than the point of its claw (**Fig. 3.2.103**). The means of distinguishing this genus from *Brechmorhoga* are unreliable, and the keys to both should be checked.

.....*Macrothemis* Hagen, 1868..p. 337

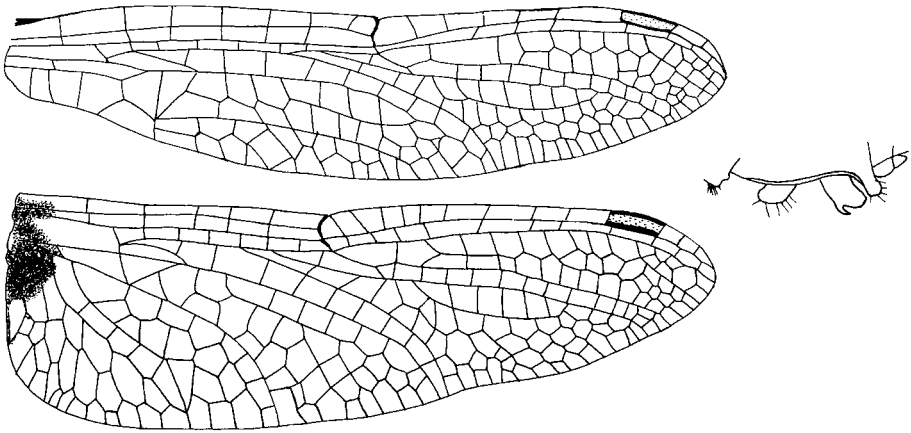


Fig. 3.2.101 *Idiataphe amazonica*: fore and hind wing (left), lateral view of the male genitalia on the second abdominal segment. Part based on Rácenis (1969).

36. Three cells border on the triangle in the discoidal space of the fore-wing. Vein R_3 is strongly sinuous. There is no additional cell between the triangle and anal loop. There is a transverse carina on the fifth abdominal segment. The base of the hind wing is very wide with eight or more rows of cells in the anal field (**Fig. 3.2.98**).

.....*Pantala* Hagen, 1861..p. 358

- There are three or four cells bordering the triangle in the discoidal space of the fore-wing (**Fig. 3.2.104**). If there are three, one of the other characters is lacking.

.....37

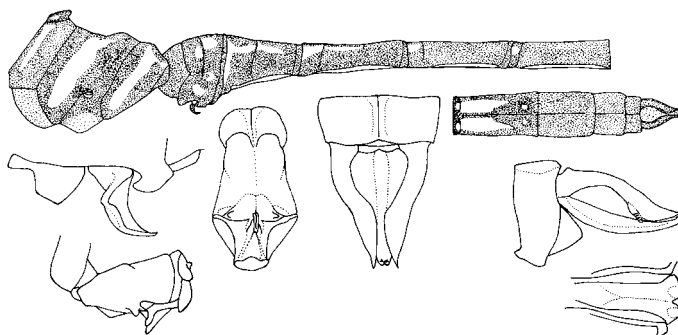


Fig. 3.2.102 *Brechmorhoga neblinae*: synthorax and six anterior abdominal segments in lateral view (above); seventh through ninth abdominal segments in dorsal view (upper middle right); male genitalia on the second abdominal segment in lateral view (middle left); penis in ventral (lower left center) and lateral view (lower left); apex of a male abdomen in dorsal (lower center) and lateral view (lower middle right); vulvar lamina on the ninth abdominal segment of a female in ventral view (lower right). Based on DeMarmels (1989a).

37. The distance between the first and second antenodal cross veins in the fore-wing is very great (**Fig. 3.2.104**).38

- The distance between the first and second antenodals in the fore-wing is not notably greater than the distance between the others (**Fig. 3.2.105**).39

38. Four cells border on the triangle in the discoidal space of the fore-wing. The pterostigma is small (**Fig. 3.2.104**).

.....*Tramea* Hagen, 1861..p. 360

- Three cells border on the triangle in the discoidal space of the fore-wing. The pterostigma is not small. There is an additional cell between the triangle and the anal loop (**Fig. 3.2.105**).

.....*Tauriphila* Kirby, 1889..p. 367

39. The anal space in the fore-wing is very broad, consisting of 5 to 6 cells at the level of the triangle, some arranged vertically bordered by veins resembling sectors. There are two rows of cells between MA and Mspl (**Fig. 3.2.106**).

.....*Paltothemis* Karsch, 1889

There is only one species in this genus reported from South America: *Paltothemis lineatipes* Karsch, 1889, known chiefly from North and Central America, but which has also been reported from Venezuela and Brazil. It has a variegated color pattern on the abdomen, but in some specimens, the pattern is somewhat obscured by a bright red coloration. Total length: 44 to 53 mm. Length of abdomen: 29 to 36 mm. Hind wing length: 41 to 46 mm.

- There are only two or three vertical rows of cells between vein A_3 and the border of the wing (Fig. 3.2.102).40

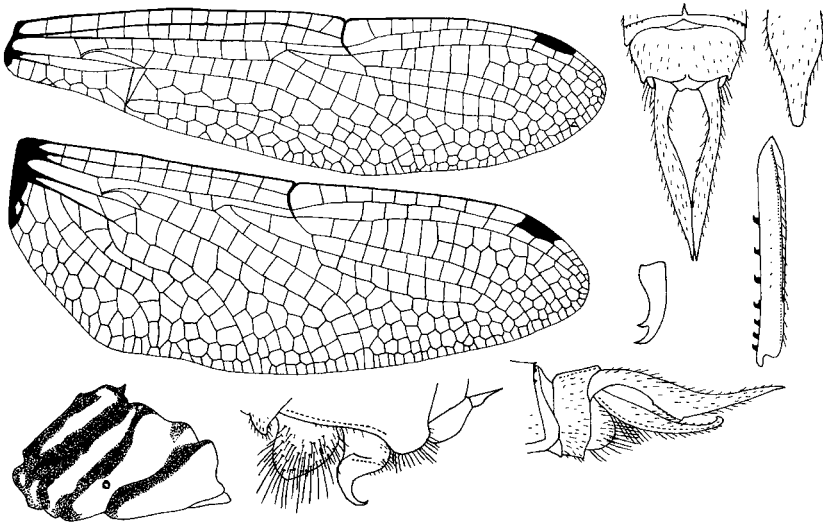


Fig. 3.2.103 *Macrothemis brevidens* male: fore and hind wing (upper left), color pattern on the lateral surface of the synthorax (lower left), genitalia on the second abdominal segment (lower center), outer surface of the hind femur (middle right), tarsal claw from the hind leg (middle right center), apex of the male abdomen in dorsal (upper right center) and lateral view (lower right), and the inferior anal appendage in ventral view (upper right). Based on Belle (1983a).

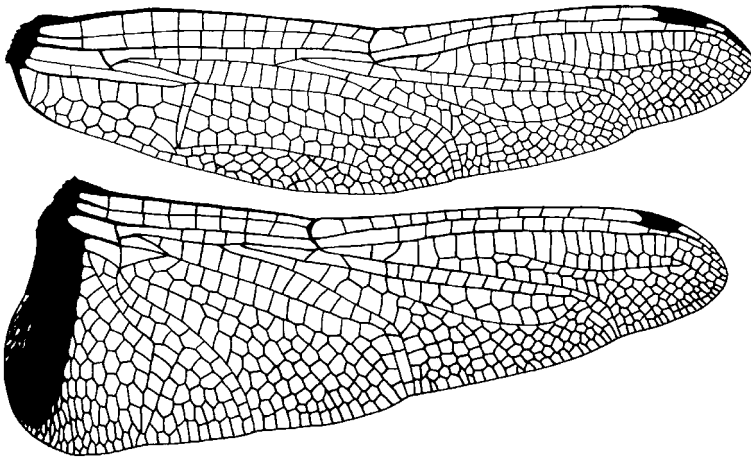


Fig. 3.2.104 Fore and hind wing of *Tramea abdominalis*. Based on Needham and Westfall (1955).

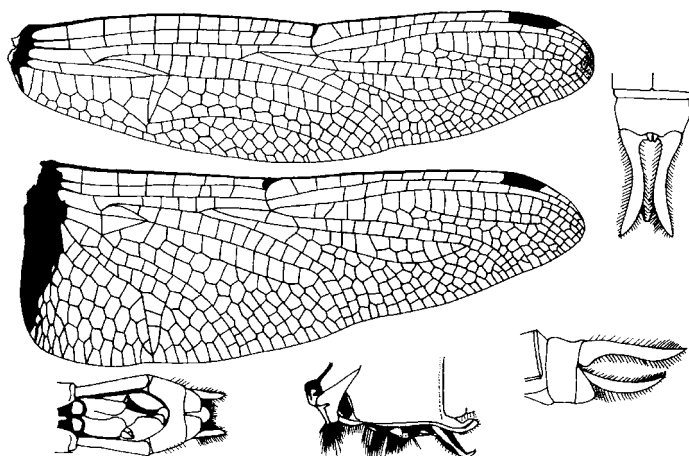


Fig. 3.2.105 *Tauriphila risi*: fore and hind wing (upper left), male genitalia on the second abdominal segment in lateral view (lower center), apex of the male abdomen in dorsal (upper right) and lateral view (lower right), and apex of the female abdomen in ventral view (lower left). Based on Ris (1919).

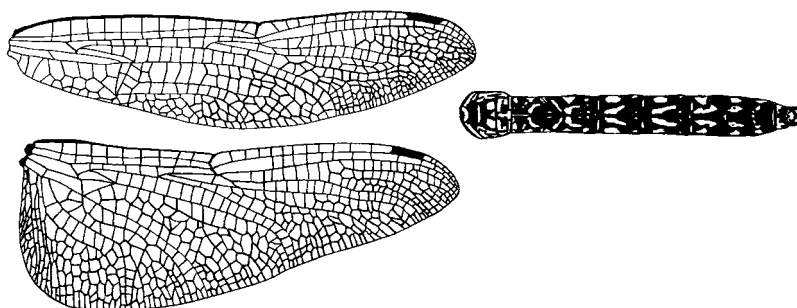


Fig. 3.2.106 *Paltothemis lineatipes* female: fore and hind wing (left) and an example of the somewhat variable color pattern on the abdomen (right).

40. The pterostigma is small. There is only one row of cells IR_3 - $Rspl$ (**Fig. 3.2.102**).

.....*Brechmorhoga* Kirby, 1894 pars..p. 325

- The pterostigma is not small. There are usually two rows of cells IR_3 - Rspl (Fig. 3.2.106). In exceptional specimens, the last antenodal cross vein in the fore-wing may be complete.41

41. The anterior lamina on the ventral side of the second abdominal segment of the male forms an elongated plate that is larger than the genital lobe (Fig. 3.2.107). There are $9\frac{1}{2}$ to $16\frac{1}{2}$ antenodal cross veins in the fore-wing. The apical segments of the abdomen may not be flattened, but if they are, they are widened laterally.

.....*Elasmothemis* Westfall, 1988 p. 371

- The anterior lamina on the ventral side of the second abdominal segment of the male does not form a plate-like structure and appears smaller than the genital lobe (Fig. 3.2.108). There are $12\frac{1}{2}$ or $13\frac{1}{2}$ antenodal cross veins in the fore-wing. The apical segments of the abdomen may not be flattened, but if they are, they are widened dorsoventrally.

.....*Dythemis* Hagen, 1861..p. 374

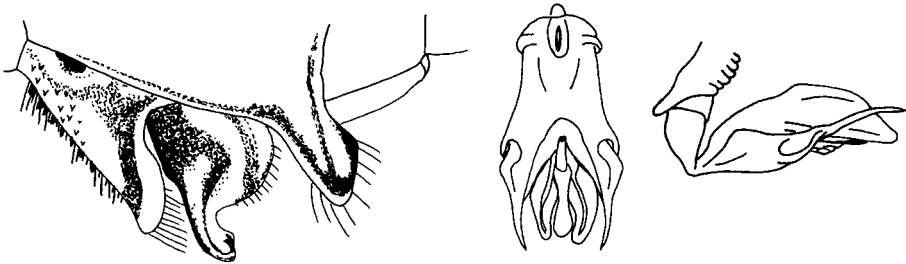


Fig. 3.2.107 *Elasmothemis williamsoni* male (left to right): genitalia on the second abdominal segment and apex of the penis in ventral and lateral view. Based on Westfall (1988).

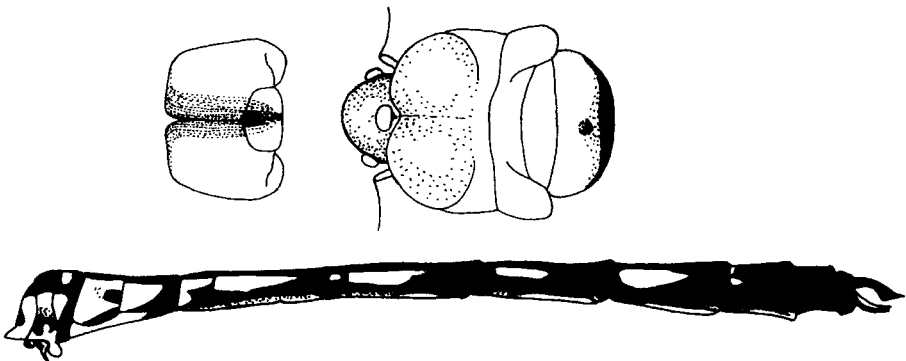


Fig. 3.2.108 *Dythemis sterilis* male: labium and the part of the head between the compound eyes with the ventral parts facing right (above, left and right, respectively), and the color pattern on the abdomen in lateral view. Based on DeMarmels (1989b).

Key to the genera of known larvae of the Libellulidae in South America

Information for the key was provided by Geijskes (1935), Bick (1953), Gloyd and Wright (1959), DeMarmels (1981b, 1990a), Rodrigues Capítulo (1996), Irineu de Souza *et al.* (1999a, b, 2002), Needham *et al.* (2000), Carvalho *et al.* (2002), and Fleck (2003a, b). Larvae of *Antidythemis*, *Edonis*, *Misagria*, *Nothodiplax*, *Tholymis*, *Uracis*, and *Ypirangathemis* have not yet been described.

1. There are no mid-dorsal hooks, spines, or knobs on any of the abdominal segments (**Fig. 3.2.109**).2
 - On at least one of the abdominal segments, there is a mid-dorsal hook, spine, or knob (**Fig. 3.2.110**).12
2. The apical third of the cerci and paraprocts are strongly curved ventrad. In frontal view, the compound eyes do not protrude dorsad above the level of the rest of the head. The body is truncate and compressed laterally. The lateral spines on the ninth abdominal segment are obviously shorter than half the length of the ninth segment measured along the midline (**Fig. 3.2.109**).*Erythemis* Hagen, 1861..p. 160
 - The apical third of the cerci and paraprocts are straight or only slightly curved (**Fig. 3.2.111**).3

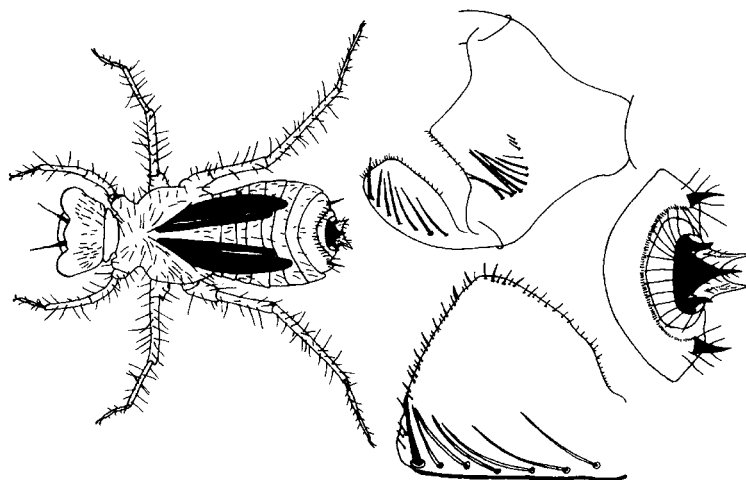


Fig. 3.2.109 *Erythemis credula* larva: habitus (left), part of the labium in dorsal view without one palp (upper center), labial palp in dorsal view (lower center), and the apex of the abdomen in dorsal view. Based on Santos (1969a).

3. There are only three long setae arising very close to each other in each row on the prementum (**Fig. 3.2.111**).4

- Each row of long setae on the prementum consists of at least four setae (**Fig. 3.2.112**). The compound eyes are small and protrude prominently, or they do not protrude above the dorsal surface of the head at all.5

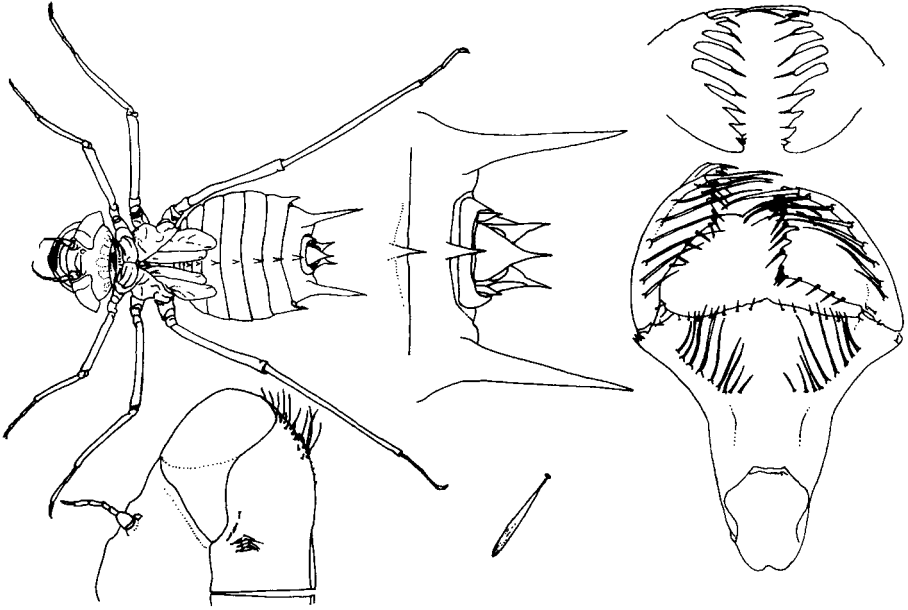


Fig. 3.2.110 *Diastatops pullata* larva: habitus (upper left), right side of head in dorsal view (lower left), a modified seta from the head (lower center), apex of the abdomen in dorsal view (center), labium in dorsal view (lower right), and frontal view of the labial palps (upper right). Based on Fleck (2003a).

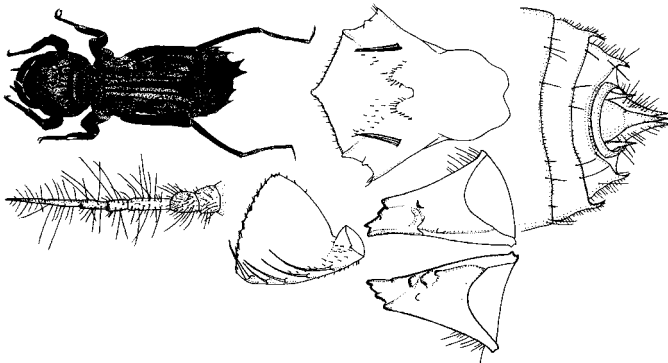


Fig. 3.2.111 *Dasythemis venosa* larva: habitus (upper left), antenna in dorsal view (lower left), dorsal view of the prementum of the labium (upper center) and the labial palp (lower left center), internal view of the mandibles (lower right center), and the apex of the abdomen in dorsal view (right). Based on Carvalho *et al.* (2002).

4. The head is large with small compound eyes, located at the anterolateral corner. Each eye has a prominent conical protrusion on the anterodorsal surface. There are five long palpal setae proximal to the movable hook. A very small spine is at each posterolateral corner of the eighth and ninth abdominal segments (**Fig. 3.2.113**). The color of the only known South American species is dark yellow or dark red, and the final instar is about 18 to 18.5 mm long.

.....*Cannaphila* Kirby, 1889

Only one species has been found in South America: *Cannaphila vibex* (Hagen, 1861), also known by the synonyms *Libellula vibex* Hagen, 1861; and *Libellula merida* Selys, 1868. It inhabits Central America, Colombia, Ecuador, Peru, Venezuela, Bolivia, Argentina, and Brazil.

- The compound eyes protrude only slightly above the dorsal surface of the head, best seen in dorsal view. There are usually four long setae on each labial palp proximal to the movable hook (**Fig. 3.2.111**).

.....*Dasythemis* Karsch, 1889..p. 307

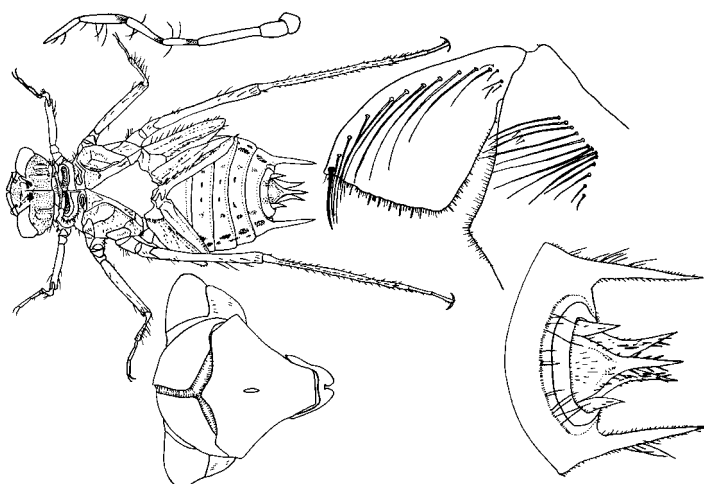


Fig. 3.2.112 *Rhodopygia hollandi* male larvae: habitus of an exuvia (middle left), antenna (upper left), ventral view of labium (lower left), labial palp and part of the prementum in dorsal view (upper right), and the apex of the abdomen in dorsal view (lower right). Based on DeMarmels (1990a).

5. There are no lateral spines on the eighth abdominal segment, but the lateral spines on the ninth segment are long. The distal margin of the lateral palps lack distinct crenulations (**Fig. 3.2.112**).

.....*Rhodopygia* Kirby, 1889..p. 227

These characteristics are shared by larvae of *Tarnetrum* Needham and Fisher, 1936, sometimes treated as a subspecies of *Sympetrum* with no species known from South America.

- There are lateral spines on the eighth abdominal segment (**Fig. 3.2.114**).6
- 6. The length of the ninth abdominal segment measured along its dorsal midline is obviously less than the length of one of its lateral spines (**Fig. 3.2.115**).7
- The length of the ninth abdominal segment measured along its dorsal midline is obviously greater than the length of one of its lateral spines. Each lateral spine on the eighth abdominal segment is shorter than the segment measured along the mid-dorsal line (**Fig. 3.2.114**).8

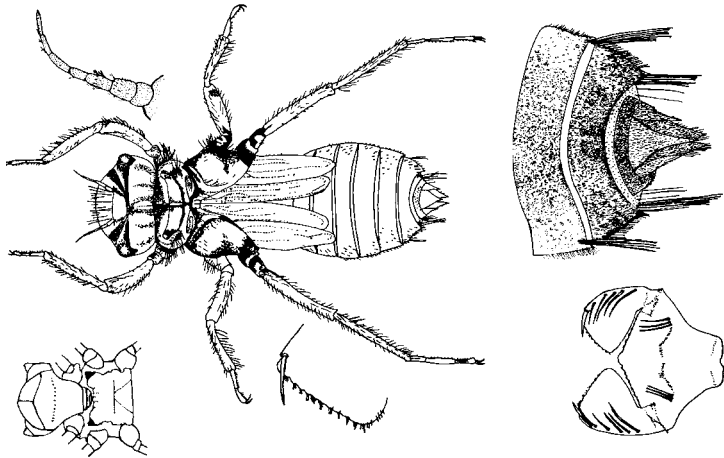


Fig. 3.2.113 *Cannaphila vibex* larva: habitus (middle left), antenna (upper left), ventral view of head and thorax (lower left), labium in dorsal view (lower right), distal margin of a lateral palp showing the movable hook and crenulations (lower center), and apex of the abdomen in dorsal view (upper right). Based on Limongi (1990).

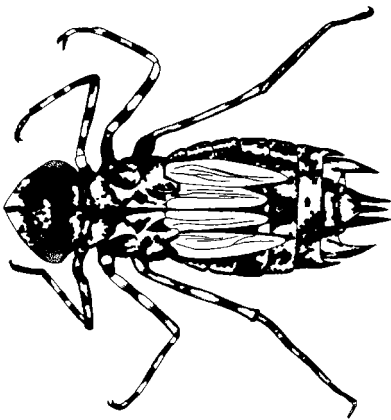


Fig. 3.2.114 Habitus of a *Pantala flavescens* final instar larva. Based on Van Damme and Dumont (1999).

7. The lateral spines on the eighth and ninth abdominal segments are approximately equal in length. Each lateral spine on the eighth abdominal segment is as long as or longer than the segment measured along the mid-dorsal line. Each lateral spine on the ninth abdominal segment is approximately twice as long as the segment measured along the mid-dorsal line. The distal margin of the lateral palps have distinct crenulations. The coloration of all tarsi is uniformly ochraceous (**Fig. 3.2.116**).

.....*Tramea* Hagen, 1861..p. 360

- The lateral spines on the ninth abdominal segment are obviously longer than those on the eighth (**Fig. 3.2.114**). The fore-tarsi are lighter in color than those on the middle and hind legs.

.....*Pantala* Hagen, 1861 pars..p. 358

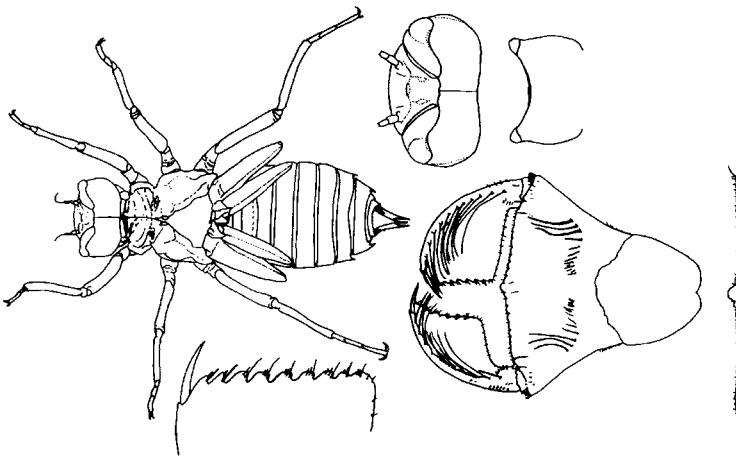


Fig. 3.2.115 *Orthemis aequilibris* larva: habitus from an exuvia (upper left), head without the apical segments of the antennae in dorsal (upper center) and posterior view showing the protrusions of the compound eyes (upper right), labium in dorsal view (lower right center), inner margin of a labial palp (lower left center), and the anterior margin of the prementum (right). Based on Fleck (2003a).

8. The compound eyes are small and seem to protrude dorsad above the surface of the head in frontal view. There are 8 to 10 premental setae, the lateral 3 or 4 of which are larger than the others, which are small and indistinct (**Fig. 3.2.115**).

.....*Orthemis* Hagen, 1861..p. 167

- The compound eyes are large but do not protrude above the surface of the head in frontal view. There are 11 to 15 premental setae, or, if there are 10, the sixth through tenth abdominal segments each bear a dense mid-dorsal tuft of hair-like setae (**Fig. 3.2.117**).9

9. In lateral view, the paraprocts appear more than twice as long as the cerci and much longer than the epiproct (**Fig. 3.2.117**).10
- In lateral view, the paraprocts appear less than twice as long as the cerci and almost as long or slightly longer than the epiproct (**Fig. 3.2.118**).11

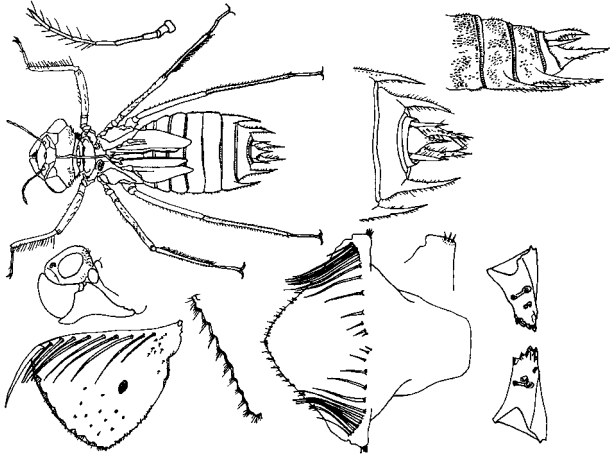


Fig. 3.2.116: *Tramea calverti* larva: habitus from an exuvia (upper middle left), antenna (upper left), head in lateral view (lower middle left), labial palp (lower left), inner margin of a labial palp (lower left center), prementum in dorsal view (lower right center) with an enlargement of the setae at the articulation of the labial palp above it, inner surfaces of mandibles (lower right), and apex of the abdomen in dorsal (upper middle right) and lateral view (upper right). Based on Irineu de Souza *et al.* (1999a).

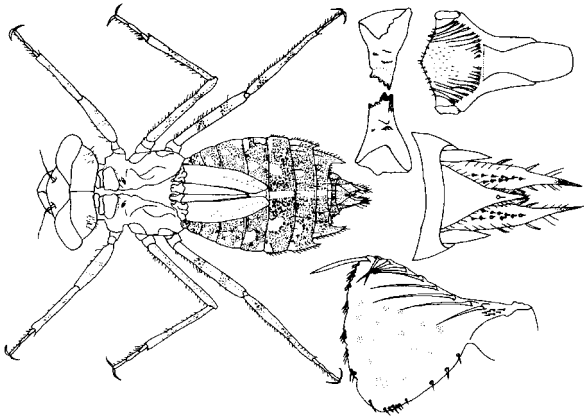


Fig. 3.2.117 *Micrathyria hesperis* larva: habitus from exuvia (left), prementum (upper right), mandibles (upper right center), right labial palp (lower right), and caudal appendages (middle right). Based on de Assis and Costa (1994).

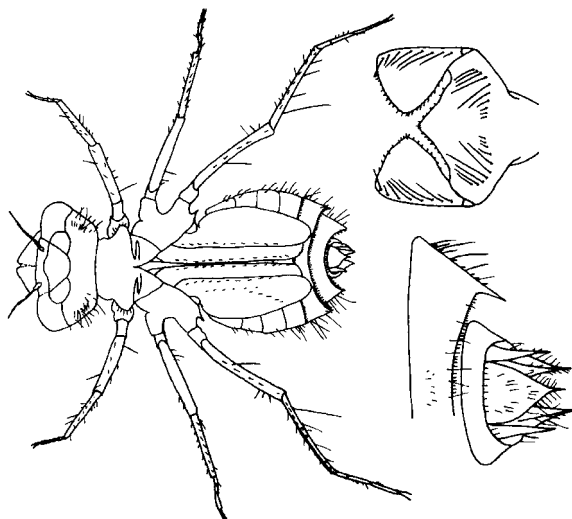


Fig. 3.2.118 *Erythrodiplax fusca* larva: habitus (left), labium in dorsal view (upper right), and the apex of the abdomen in dorsal view (lower right). Based on Santos (1967c).

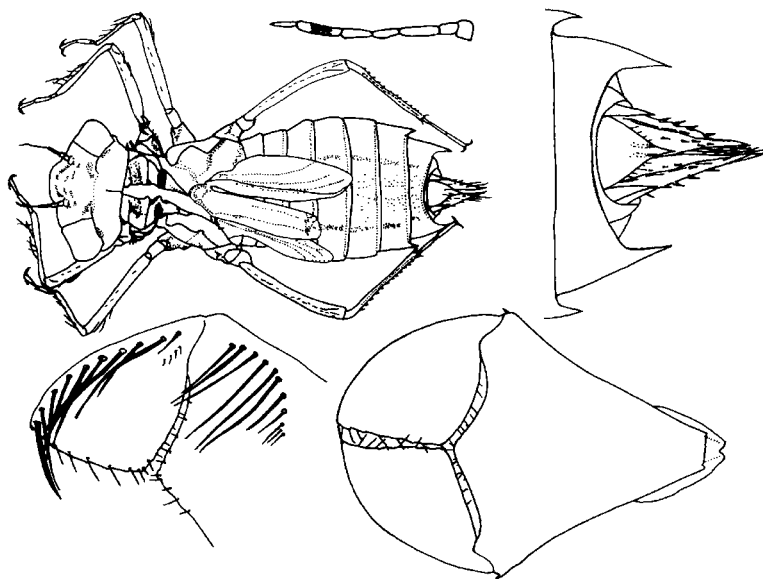


Fig. 3.2.119 *Nephepeltia phryne* female larva: habitus based on an exuvia (upper left), antenna (upper center), apex of the abdomen in dorsal view (upper right), labium in ventral view (lower left), and labial palp and part of the prementum in dorsal view. Based on DeMarmels (1990a).

10. A well-defined dorsal color pattern of light and dark spots is usually observable. There are no prominent dark setae on the dorsal surface of the femora near the apex. The paraprocts extend caudad about 1.5 times as far as the epiprocts (**Fig. 3.2.117**).

.....*Micrathyria* Kirby, 1889..p. 183
 - The dorsal coloration is nearly uniform and lacks an obvious pattern. The femora have two to four long setae in the apical half, and the tibiae bear about ten such setae, mainly in the apical part. The paraprocts extend caudad about twice as far as the epiproct and three times as far as the cerci (**Fig. 3.2.119**).

.....*Nephepeltia* Kirby, 1889..p. 180
 11. The dorsal coloration is nearly uniform and lacks an obvious pattern. The caudal appendages usually curve slightly ventrad. The lateral spines on the eighth and ninth abdominal segments are usually nearly equal in length. The caudal appendages may curve slightly ventrad. The body usually appears hairy (**Fig. 3.2.118**).

.....*Erythrodiplax* Brauer, 1868..p. 230
 - There is a distinct dorsal color pattern of light and dark markings. The caudal appendages are always straight (**Fig. 3.2.120**).

.....*Anatya* Kirby, 1889..p. 310

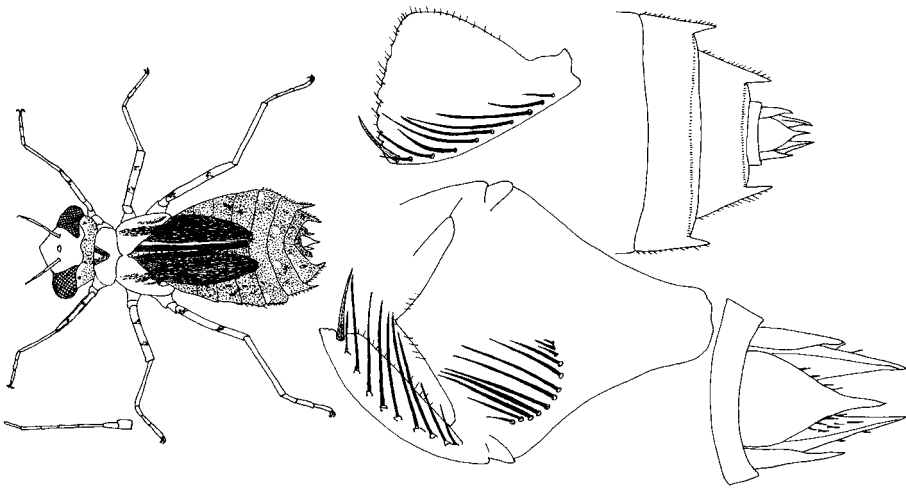


Fig. 3.2.120 *Anatya januaria* larva: habitus (upper left), antenna (lower left), labium with one of the palps partially removed (lower center), one labial palp (upper center), apical segments of the abdomen in dorsal view (upper right), and enlarged tenth abdominal segment and appendages in dorsal view (lower right). Based on Santos (1973b).

12. There is a laterally expanded conical region on the compound eyes. The labial palps have finger-like crenulations along their distal margins (**Fig. 3.2.110**).13
 - Neither laterally expanded conical regions on the eyes nor finger-like crenulations along the distal margins of the labial palps are present (**Fig. 3.2.121**).14
 13. Digitiform crenulations are present along the entire length of the distal margin of the lateral palps. The length measured along the dorsal midline of the ninth abdominal segment is more than $\frac{1}{4}$ the length of one of its lateral spines.*Zenithoptera* Selys, 1860..p. 147
 - Digitiform crenulations are absent from the third of the distal margin of the lateral palps adjacent to the inner margins of the palps. The length measured along the dorsal midline of the ninth abdominal segment is equal to or less than $\frac{1}{4}$ the length of one of its lateral spines (**Fig. 3.2.110**).*Diastatops* Rambur, 1842..p. 141
 14. There is a mid-dorsal spine, hook, or knob on the ninth abdominal segment (**Fig. 3.2.121**).15
 - There is no mid-dorsal spine, hook, or knob on the ninth abdominal segment (**Fig. 3.2.122**).28
 15. In dorsal view, the width of the epiproct base is less than $\frac{1}{2}$ of the epiproct length (**Fig. 3.2.121**). Each lateral spine on the ninth segment does not extend as far as the mid-length of the epiproct.16
 - In dorsal view, the width of the epiproct base is more than $\frac{1}{2}$ of the epiproct length (**Fig. 3.2.123**).17

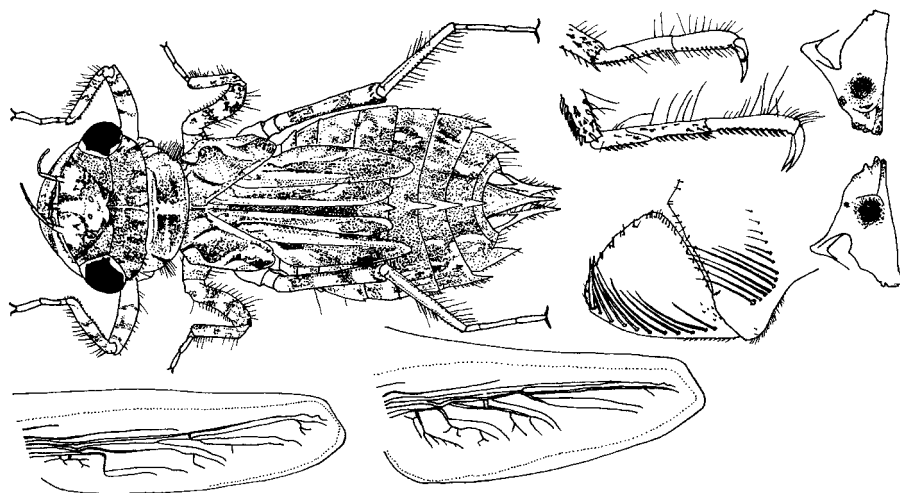


Fig. 3.2.121 *Brachymesia furcata* larva: habitus (upper left), part of the mentum and the labial palp (lower right behind habitus), inner surfaces of mandibles (upper right), tarsi of the middle and hind leg (upper right center, above and below, respectively), and the fore and hind wing buds (below habitus, left and right, respectively). Based on Geijskes (1935).

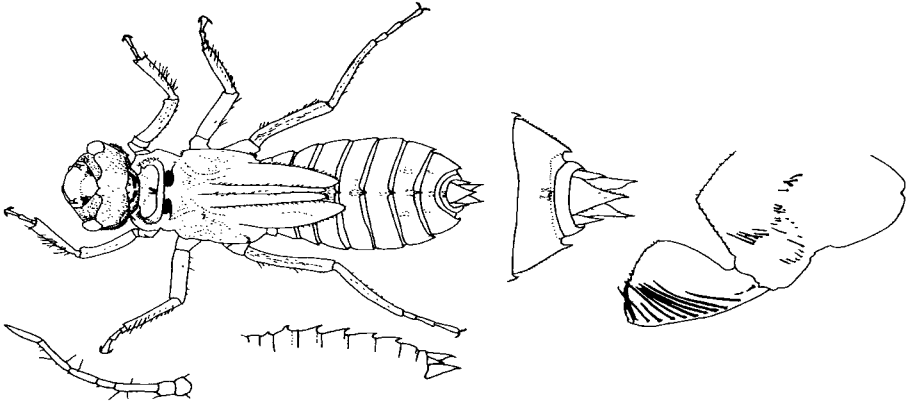


Fig. 3.2.122 *Libellula herculea* larva: habitus of a male (upper left), antenna (lower left), lateral profile of the dorsal and posterior parts of the abdomen (lower left center), apex of the abdomen in dorsal view (right center), and one side of the labium (right). Based on DeMarmels (1982a).

16. There are 5 or 6 long setae on the labial palp. The combined length of the eighth and ninth abdominal segments is shorter than the length of the epiproct. The mid-dorsal length of the ninth abdominal segment is not more than twice as long as that segment's lateral spine (**Fig. 3.2.124**). There are mid-dorsal hooks on the third through tenth abdominal segments.

.....*Idiataphe* Cowley, 1934..p. 323

- There are 9 to 11 long setae on the labial palp. The tenth abdominal segment may lack a mid-dorsal spine. The mid-dorsal length of the ninth abdominal segment is more than twice as long as the spine on that segment (**Fig. 3.2.121**).

.....*Brachymesia* Kirby, 1889..p. 321

17. One seta much longer than the hook is inserted on each side of the mid-dorsal hook on the fifth through ninth abdominal segments. The wing buds diverge strongly. On each side of the prementum, there is a row of 4 long and 4 short setae. The hind leg is longer than the body. Total length: 9 to 10.5 mm.

.....*Argyrothemis* Ris, 1911

The only known species in this genus is *Argyrothemis argentea* Ris, 1911 from Peru, Venezuela, Surinam, French Guiana, and Brazil.

- None of the setae at the base of each middorsal hook is considerably longer than the hook, or the wing buds are not strongly divergent.18

18. The third antennal segment is not obviously longer than the second. In case it appears to be slightly longer, the prementum is as wide or wider than long and bears about nine premental setae on each side. There are lateral spines on the eighth and ninth segments of the abdomen (**Fig. 3.2.123**).19

- The third antennal segment is distinctly longer than the second. The prementum widens gradually from the base to the apex, and its lateral margins appear straight or only slightly concave in ventral view (**Fig. 3.2.125**).20

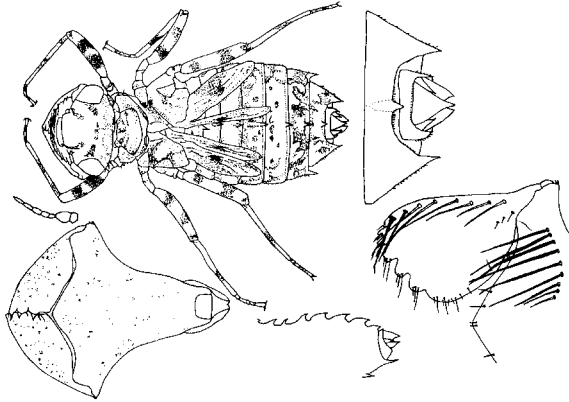


Fig. 3.2.123 *Elga leptostyla* female larva: habitus (upper left), antenna (middle left), ventral view of labium (lower left), one labial palp and the anterior part of the prementum (lower right), profile of the dorsal surface of the abdomen (lower center), and the apex of the abdomen in dorsal view (upper right). Based on DeMarmels (1990a).

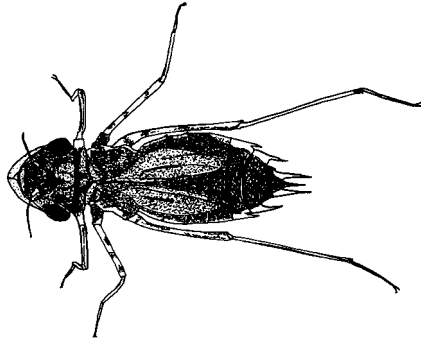


Fig. 3.2.124 Habitus of an *Idiataphe cubensis* larva; the species has not been reported from South America. Based on Needham and Westfall (1955).

19. The antenna is very small and apparently consists of seven segments, the third of which is much thinner and shorter than the second. The prementum widens strongly in its apical half, so that its lateral margin is deeply concave. There are seven palpal setae. The apical end of the labial palp has five very prominent lobes (**Fig. 3.2.123**). The final instar of *Elga leptostyla*, the only larva yet described, reaches a length of only about 11.5 mm.

.....*Elga* Ris, 1911..p.289

- The antenna is not very small and consists of eight or nine segments. The prementum is wider than long and bears about nine setae on each side. Its sides are moderately concave. There are about six setae on the labial palp proximal to the movable hook, and the crenulations on the distal margin are well developed (Fig. 3.2.126).

.....*Oligoclada* Karsch, 1889..p. 290
The placement in the key is tentative because the larvae of most South American species in this genus have not yet been described.

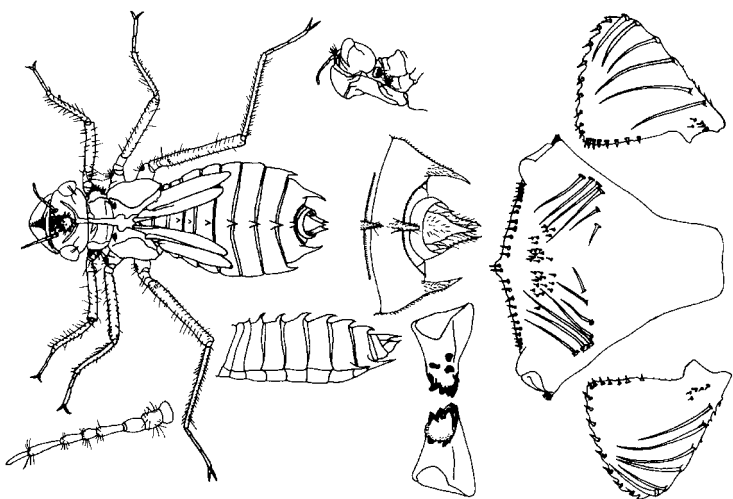


Fig. 3.2.125 *Planiplax phoenicura* larva: habitus from exuvia (upper left), antenna (lower left), head in lateral view (upper center), lateral profile of abdomen (lower left center), apical abdominal segments in dorsal view (center), mandibles (lower center), and the prementum in dorsal view with the labial palps detached on each side (right). Based on Irineu de Souza *et al.* (1999b).

20. The lateral spines on the ninth segment of the abdomen are as long as the middorsal length of the segment and reach almost to the apices of the paraprocts and epiproct. The third through ninth abdominal segments bear mid-dorsal hooks (Fig. 3.2.125).21
- The lateral spines on the ninth segment of the abdomen are shorter than the middorsal length of the segment and reach only, at most, to the mid-length of the epiproct (Fig. 3.2.127).23
21. There are five major setae on the labial palp with the apical one resembling the movable hook at the apex. Each crenulation on the distal margin of the labial palp bears only one seta. The abdomen is almost twice as long as wide (Fig. 3.2.125).

.....*Planiplax* Muttkowski, 1910..p. 318

- There are at least seven major setae on each labial palp. The abdomen is depressed and, excluding the lateral spines and appendages, only slightly longer than wide (**Fig. 3.2.128**).22

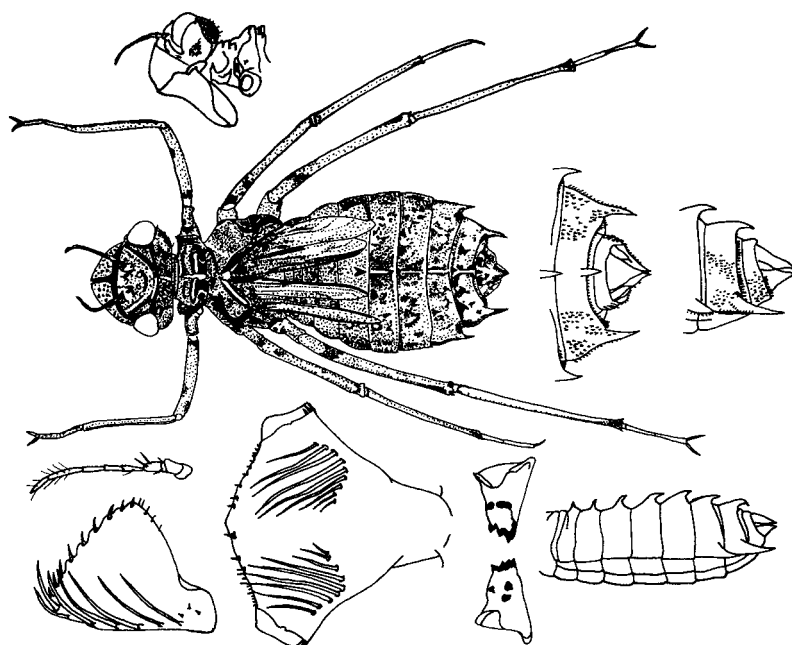


Fig. 3.2.126 *Oligoclada laetitia* larva: habitus from exuvia (upper left) with a lateral view of the head above it, antenna (lower middle left), labial palp (lower left), labium (lower left center), the two mandibles (lower middle right), outline of the abdomen in lateral view (lower right), and the apical segments of the abdomen in dorsal and lateral view (middle right, left and right, respectively). Based on Irineu de Souza *et al.* (2002).

22. The lateral spines on the eighth abdominal segment to not extend posteriad as far as the bases of the caudal appendages. There are eight or more major setae on each labial palp (**Fig. 3.2.128**).

.....*Tauriphila* Kirby, 1889 pars..p. 367

- The lateral spines on the eighth abdominal segment extend approximately as far posteriad as the apex of the epiproct. There are seven major setae proximal to the movable hook on each labial palp (**Fig. 3.2.129**).

.....*Fylgia* Kirby, 1889

This genus includes a single species: *Fylgia amazonica* Kirby, 1889, from Ecuador, Peru, Venezuela, French Guiana, Guyana, Surinam, and Brazil. A second subspecies has been described: *Fylgia amazonica lychnitina* DeMarmels, 1989.

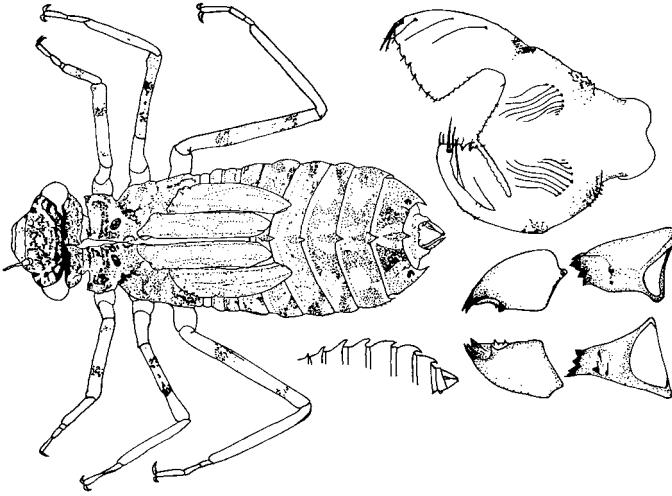


Fig. 3.2.127 *Perithemis mooma* final larval instar: habitus (left), outline of the dorsal surface of the abdomen in lateral view (lower center), prementum and labial palps in dorsal view (upper right), mandibles in posterior (lower right center) and inner view (lower right). Based on von Ellenrieder and Muzón (1999).

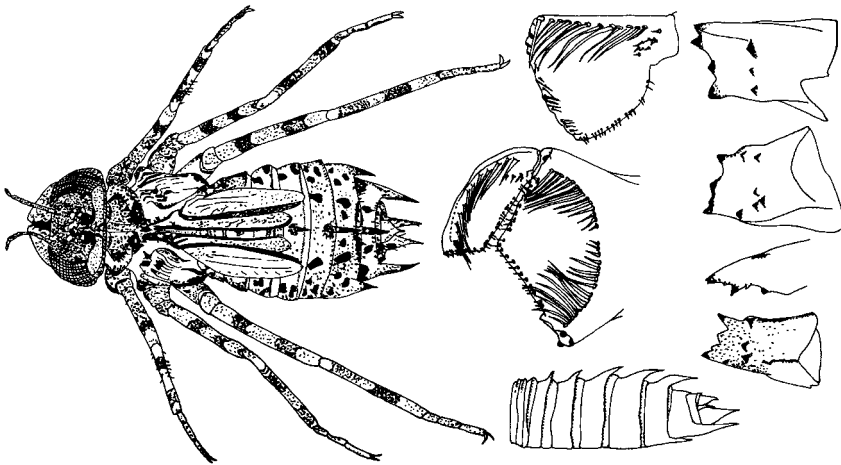


Fig. 3.2.128 *Tauriphila risi* larva: habitus (left), labium with one palp removed in dorsal view (center), internal surface of a labial palp (upper center), a pair of mandibles viewed from the inner side (upper right) and those from a second specimen in anterior (lower middle right) and internal view (lower right), and the outline of the abdomen in lateral view. Based on Rodrigues Capítulo (1996).

23. The anterior part of the occiput has a dark marking resembling a mask extending across the center of the head from one compound eye to the other. There are deep crenulations along the distal margin of the palpal lobe and five palpal setae. The dorsal hooks are cultriiform, that is, blade-shaped (**Fig. 3.2.127**). The habitat is usually lentic water, but they may also be encountered in very slightly flowing water, as well.

.....*Perithemis* Hagen, 1861..p. 148
 - There is not prominent dark marking on the occiput (**Fig. 3.2.129**).24

24. The dorsal surface of the body is granulose. There is a mid-dorsal hook on the second abdominal segment. The final instar larva bears 14 or 15 premental setae. In lateral view, each cercus appears no more than half the length of the epiproct (**Fig. 3.2.18**).

.....*Brechmorhoga* Kirby, 1894..p. 325

- The dorsal surface of the body is smooth or may bear setae, but it is not distinctly granulose. There is no mid-dorsal hook on the second abdominal segment. In lateral view, each cercus appears longer than half the length of the epiproct. The final instar larva bears fewer than 14 premental setae (**Fig. 3.2.130**).25

25. The distal margin of each labial palp has distinct, well-formed crenulations (**Fig. 3.2.130**).26

- Crenulations on the distal margin of each labial palp are, at most, indistinct (**Fig. 3.2.131**).27

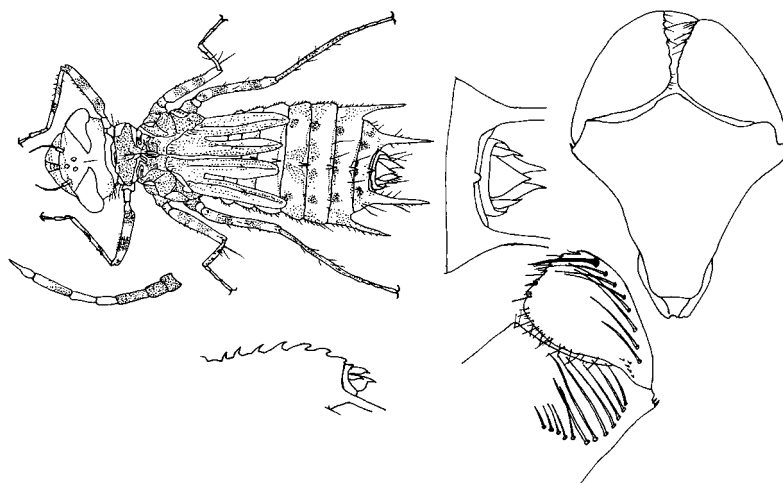


Fig. 3.2.129 *Fylgia amazonica lychnitina* larva: habitus (upper left), apex of the abdomen in dorsal view (upper center), labium with palps in ventral view (upper right), antenna (lower left), outline of the abdomen in lateral view (lower left center), and the right side of the labium and its palp in dorsal view (lower right). Based on DeMarmels (1992a).

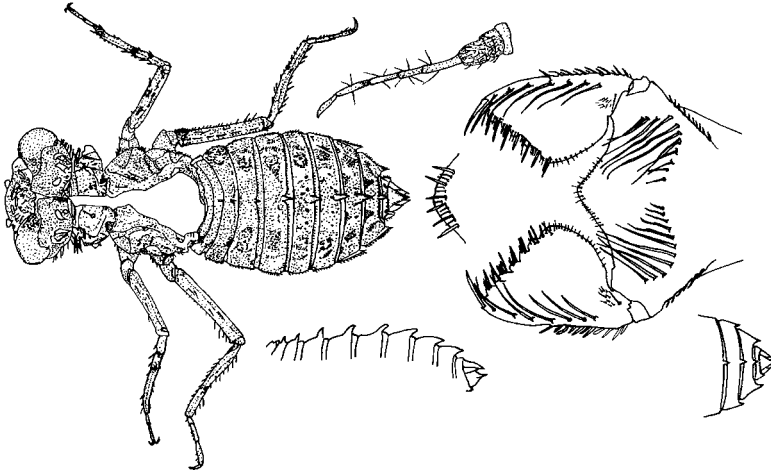


Fig. 3.2.130 *Macrothemis inequiunguis* larva: habitus based on an exuvia (upper left), antenna (upper center), labium with an enlargement of the medial border of its prementum to its left (upper right), profile of the dorsal surface of the abdomen (lower center), and the apex of the abdomen in dorsal view (lower right). Based on Ramírez and Novelo-Gutiérrez (1999).

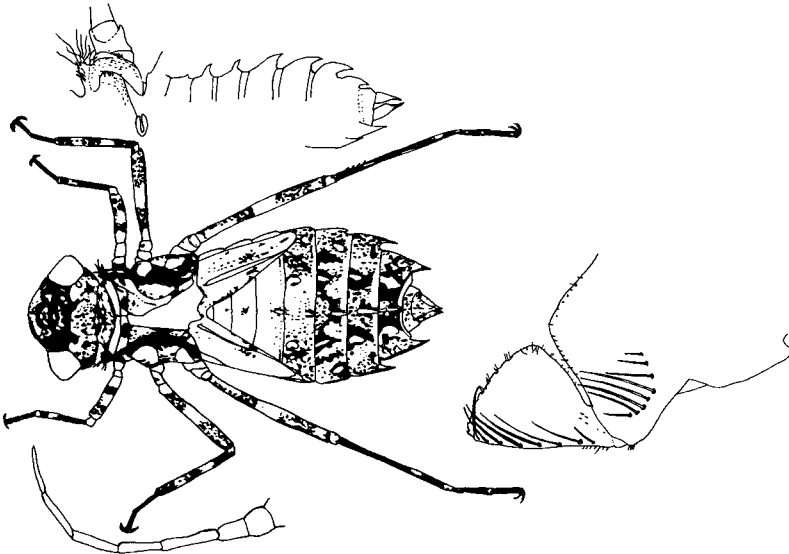


Fig. 3.2.131 *Dythemis multipunctata* larva: habitus drawn from an exuvia (middle left), antenna (lower left), prothoracic apophysis (upper left), lateral profile of the dorsal and posterior parts of the abdomen (upper left center), one side of the labium (right). Based on DeMarmels (1982a).

26. The middorsal length of the ninth abdominal segment is shorter than its lateral spine. The length of the epiproct varies from 1 to 1.5 times the length of a cercus (**Fig. 3.2.114**). On the third and fourth abdominal segments and sometimes also on the second, fifth, or both segments as well, the mid-dorsal spines are reduced in size to small papillae, which are erect in the later instars. There is usually a small spine or angled process at the apex of the tenth segment. The palpal setae number 14 or 15. The crenulations on the distal margin of each palpal lobe are deep.

.....*Pantala* Hagen, 1861 pars..p. 358
 - The mid-dorsal length of the ninth abdominal segment is more than three times the length of that segment's lateral spine. The combined length of the eighth and ninth abdominal segments is much greater than the length of the epiproct. There are mid-dorsal hooks on the third through ninth abdominal segments (**Fig. 3.2.130**).

.....*Macrothemis* Hagen, 1868..p. 337
 27. The occipital margin of the head is armed with cylindrical setae, and the setae along the interior margin of the prementum and the inner margin of the labial palp are normally pointed. There are vestiges of crenulations along the distal margin of the palpal lobe and 7 to 10 palpal setae (**Fig. 3.2.131**).

.....*Dythemis* Hagen, 1861..p. 374
 - The occipital margin of the head is armed with clavate setae, and the setae along the interior margin of the prementum and the inner margin of the labial palp are flattened at their apices (**Fig. 3.2.132**).

.....*Gynothemis* Calvert, 1909..p. 334

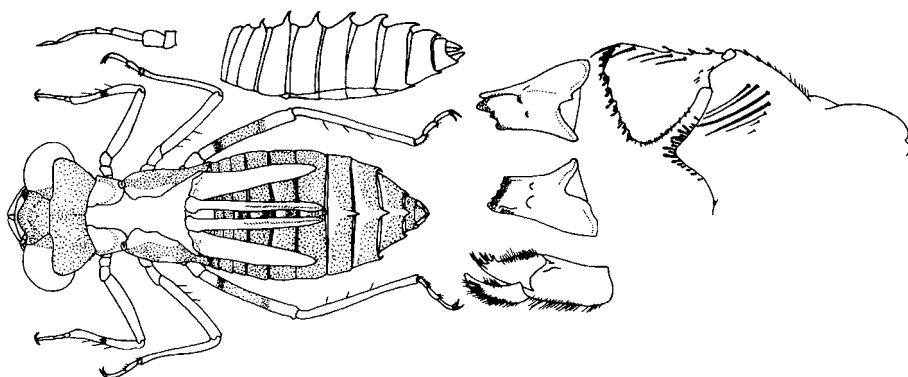


Fig. 3.2.132 *Gynothemis uniseta* larva: habitus (lower left), antenna (upper left), outline of the abdomen in lateral view (upper left center), maxilla (lower right center), mandibles in inner view (upper right center), and part of the labium showing the anterior margin of the prementum and one palp (right). Based on Geijskes (1972).

28. The compound eyes are located at the frontolateral corner of the head and usually occupy less than half its length. The abdomen is relatively long and tapers toward the apex. The median lobe of the labium lacks prominent crenulations, and the prementum bears 11 to 14 setae on each side. On each palp, there are nine or ten long setae proximal to the moveable hook (**Fig. 3.2.122**). There are lateral spines only on the eighth and ninth abdominal segments. The body is densely covered by hair-like setae.

.....*Libellula* Linnaeus, 1758..p. 180
 - The compound eyes are situated laterally and are broadly rounded. The apex of the abdomen usually appears blunt (**Fig. 3.2.133**).29

29. There are about 18 to 21 premental setae on each side in the final instar. Earlier instars have 16 or 17. On each palp, there are nine or ten long setae proximal to the moveable hook. The body is not covered by hair-like setae. The compound eyes are large and occupy half or more than half of the length of the head. There are lateral spines only on the eighth and ninth abdominal segments (**Fig. 3.2.134**).

.....*Macrodiplax* Brauer, 1868
 The only species in this genus is *Macrodiplax balteata* (Hagen, 1861), known from Central America, the West Indies, and Venezuela, where it may inhabit brackish water (Dunson, 1980). It is also known by its synonym: *Tetragoneuria balteata* Hagen, 1861.

- There are fewer than 18 premental setae on each side (**Fig. 3.2.133**).30

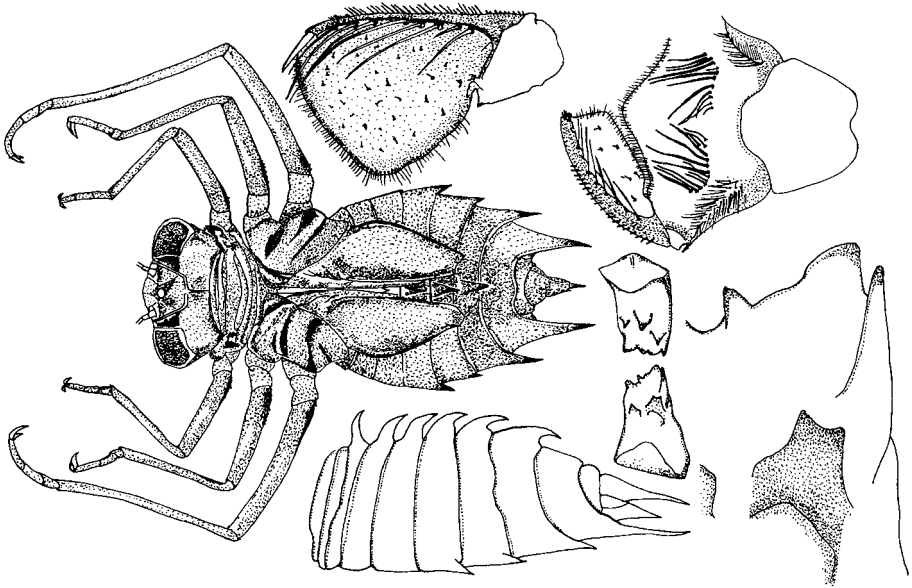


Fig. 3.2.133 *Elasmotheremis constricta* larva: habitus (left), labial palp (upper center) and labium without one palp (upper right), mandibles with an enlargement on the processes on one mandible enlarged (lower right), and lateral view of the abdomen (lower center). Based on Pujol-Luz (1990).

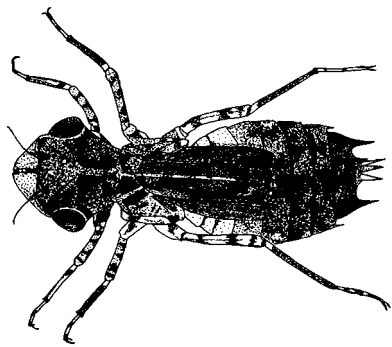


Fig. 3.2.134 Habitus of a *Macrodiplax balteata* larva.

30. The distal margin of the lateral palp lacks distinct crenulations, and there are lateral spines on the sixth through the ninth abdominal segments (**Fig. 3.2.133**).*Elasmothemis* Westfall, 1988..p. 371
- The distal margin of the lateral palp is obviously crenulated, and the sixth and seventh abdominal segments usually lack lateral spines (**Fig. 3.2.135**).31
31. The epiproct is about 1.5 times as long as each circus (**Fig. 3.2.135**).32
- The epiproct is about twice as long as each circus (**Fig. 3.2.136**).33

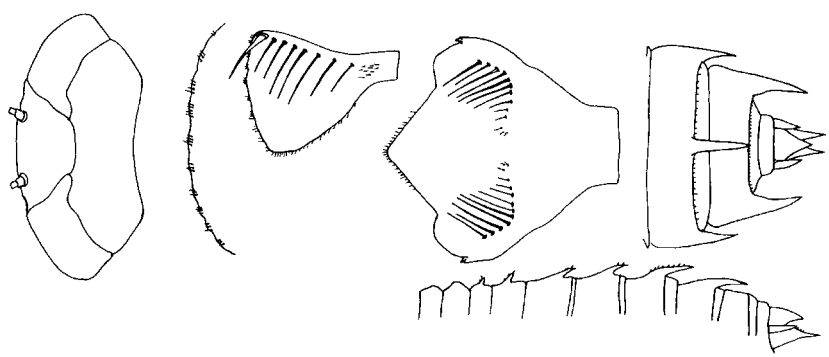


Fig. 3.2.135 *Miathyria marcella* larva (above, left to right): head in dorsal view, distal margin of the labial palp showing shallow crenulations, labial palp, prementum, apical segments of the abdomen in dorsal view, and (below right), lateral profile of the dorsal margin of the abdomen. Based on Bick (1953).

32. The mid-dorsal hooks are well developed and increase progressively in length from the second to the eighth abdominal segment. There is no dorsal hook on the ninth abdominal segment. There are 6 or 7 long setae on the labial palp and 10 to

12 long setae in each row on the prementum. There are lateral spines only on the eighth and ninth abdominal segments, and those on the ninth abdominal segment are longer than the length of the segment measured along the dorsal midline (**Fig. 3.2.135**).

.....*Miathyria* Kirby, 1889..p. 321
The mid-dorsal processes are small and spiniform and decrease in length progressively from the second to the sixth abdominal segments. There are nine setae on the labial palp and short lateral spines on the eighth and ninth abdominal segments (**Fig. 3.2.137**).

.....*Paltothemis* Karsch, 1889
There is only one species in this genus reported from South America: *Paltothemis lineatipes* Karsch, 1889, known chiefly from North and Central America, but which has also been reported from Venezuela and Brazil.

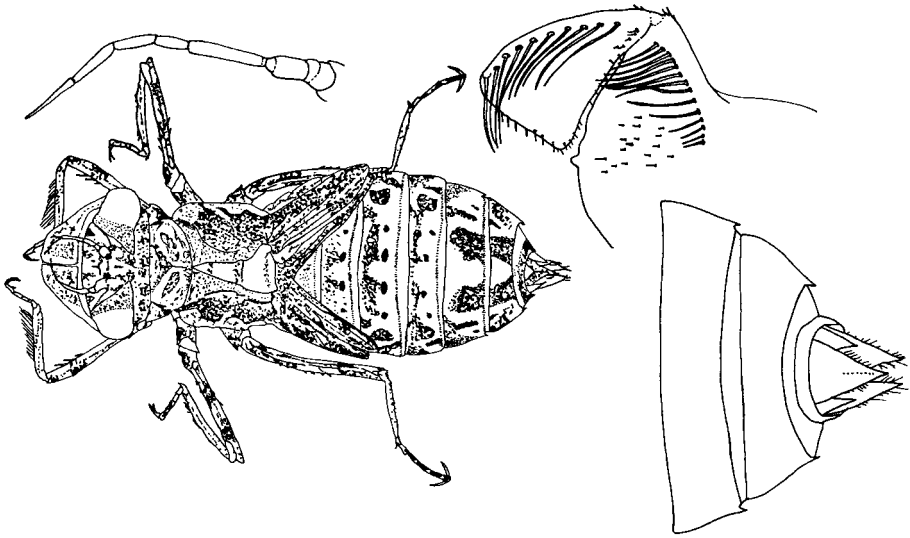


Fig. 3.2.136 *Sympetrum evanescens* larva: habitus of a female (lower left), antenna (upper left), half of the labium of a male with one lobe in dorsal view (upper right), the apex of the female abdomen in dorsal view (lower right). Based on DeMarmels (1992b).

33. The abdomen is about twice as long as its greatest width. The lateral spines on the ninth segment do not reach beyond the apices of the cerci, or, if they are longer, a mid-dorsal hook is present on the eighth abdominal segment (**Fig. 3.2.136**).

.....*Sympetrum* Newman, 1833..p.312
- The abdomen is depressed and broad, only slightly longer than wide (**Fig. 3.2.128**).

.....*Tauriphila* Kirby, 1889 pars..p. 367

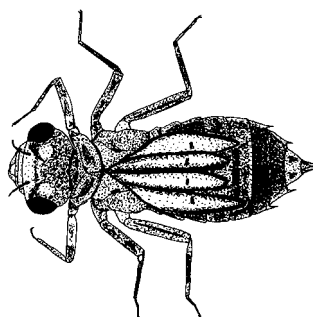


Fig. 3.2.137 Habitus of a *Paltothemis lineatipes* larva. Based on Needham and Westfall (1955).

Key to the species of adult *Diastatops* in South America

Information for the key provided by Montgomery (1940). Not enough information is available to prepare a key to the larvae.

1. The wing base to the level of the nodus is black or dark brown followed by a broad white band in mature specimens. The remainder of the wings is transparent or nearly so except for the brown costal area and the apices of both wings and a brown band two to four cells wide along the caudal margin of the hind wing. The costal postnodal cells are not crossed (**Fig. 3.2.138**).

.....*Diastatops dimidiata* (Linnaeus, 1758)
(Venezuela, French Guiana, Guyana, Surinam, Pará). Syn: *Libellula dimidiata* Linnaeus, 1758; *Diastatops fenestrata* Hagen, 1855; *Libellula marginata* De Geer, 1773.

- The entire wings are strongly colored. There are three to seven cells following the first in the costal postnodal area bisected by a longitudinal vein and anastomosing cross veins in this area (**Fig. 3.2.139**).2

2. There are no secondary anastomosing veins. The veins are usually uniformly black or brown throughout or sometimes red in the anal area. A light spot distal to the nodus is very indistinct and limited to the area near the costal margin, if it is present at all (**Fig. 3.2.140**).3

- The veins in the anal area of the hind wing or in more extensive areas are more numerous than in the remainder of wing and described as “secondary anastomosing” veins. These veins are usually red or yellow and somewhat thickened. The white spot or band just distal to the nodus is usually distinct and frequently extends across one half to two thirds of the length of the wing (**Fig. 3.2.139**).5

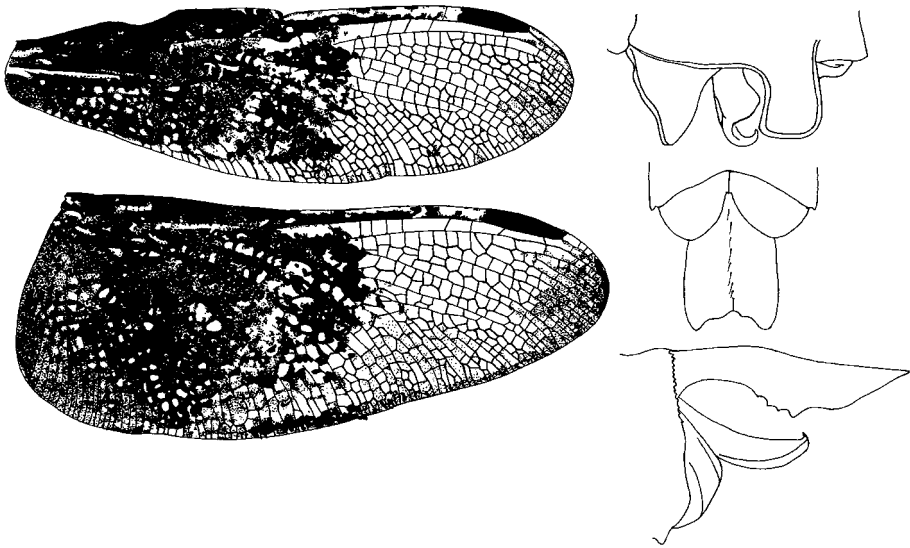


Fig. 3.2.138 *Diastatops dimidiata* male: fore and hind wing (left), and (right, top to bottom) the genitalia on the second abdominal segment in lateral view, the inferior anal appendage in ventral view, and the apex of the abdomen in lateral view. Based on Montgomery (1940).

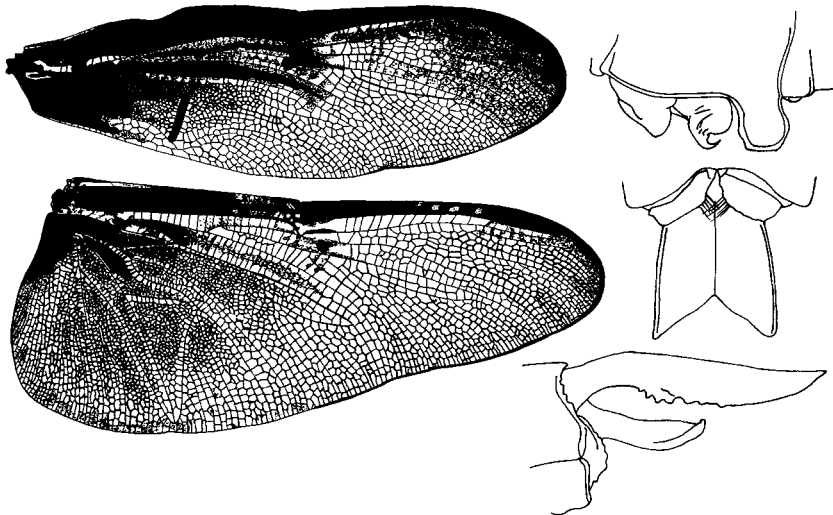


Fig. 3.2.139 *Diastatops estherae* male: fore and hind wing (left), and (right, top to bottom) the genitalia on the second abdominal segment in lateral view, the inferior anal appendage in ventral view, and the apex of the abdomen in lateral view. Based on Montgomery (1940).

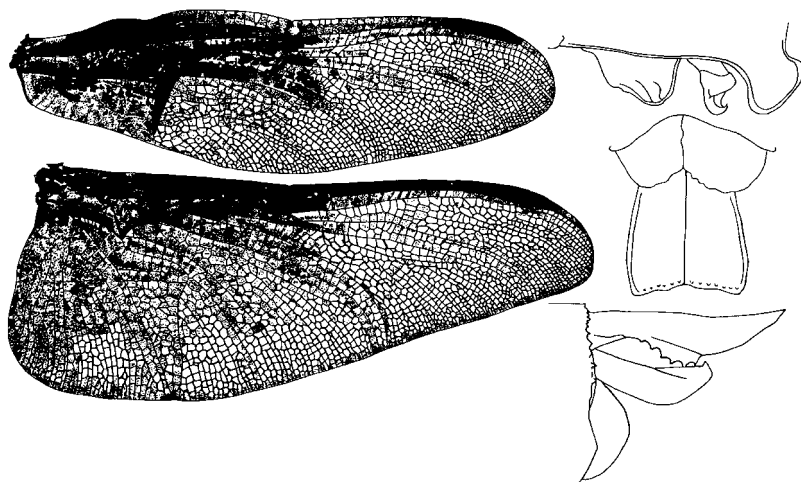


Fig. 3.2.140 *Diastatops maxima* male: fore and hind wing (left), and (right, top to bottom) the genitalia on the second abdominal segment in lateral view, the inferior anal appendage in ventral view, and the apex of the abdomen in lateral view. Based on Montgomery (1940).

3. The wings are usually less than 25 mm. The length to width ratio at the nodus is about 2.3 to 1. The length of the abdomen is usually less than 18 mm. The teeth on the superior appendages reach to or beyond the level of the apex of the inferior appendage. The median teeth are more elevated than any of the others. The sides of the inferior appendage are divergent (**Fig. 3.2.141**).

.....*Diastatops obscura* (Fabricius, 1775)
(Colombia, Venezuela, Guyana, French Guiana, Peru, Bolivia, Paraguay, Argentina, Pará, Maranhão, Bahia, Mato Grosso, Mato Grosso do Sul, Espírito Santo, São Paulo, Rio de Janeiro). Syn: *Libellula obscura* Fabricius, 1775; *Diastatops tincta* Rambur, 1842.

- The wing length is usually 25 mm or longer. The length to width ratio at the nodus is about 2.75 to 1. The length of the abdomen is usually 18 mm or more. The teeth on the ventral margin of the superior appendages do not reach the level of the apex of the inferior appendage. The teeth distal to the middle are more elevated than any of the others. The sides of the inferior appendage are sub-parallel (**Fig. 3.2.142**).4

4. The wings are about 25 mm long. Abdomen length: c. 18 mm (**Fig. 3.2.142**).

.....*Diastatops nigra* Montgomery, 1940
(Venezuela, Amazonas).

- The wings are about 30 mm long. Abdomen length: c. 22 mm (**Fig. 3.2.140**).

.....*Diastatops maxima* Montgomery, 1940
(Amazonas).

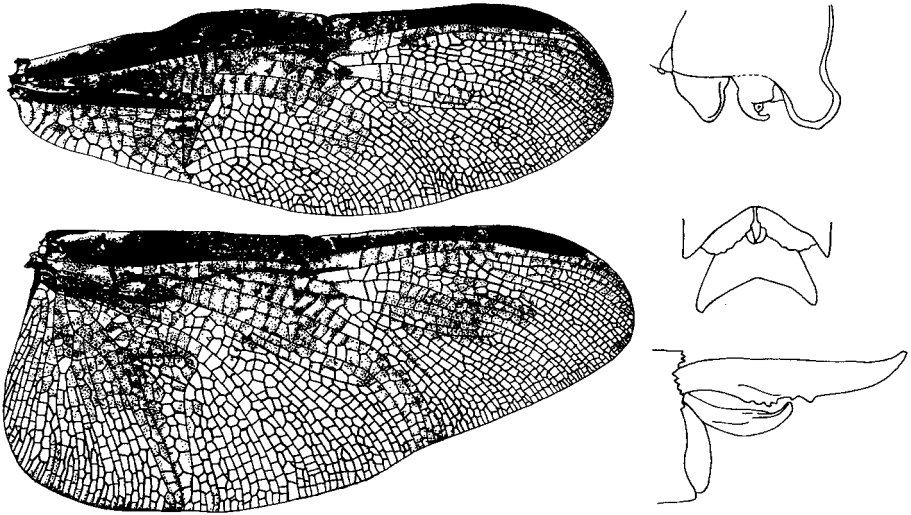


Fig. 3.2.141 *Diastatops obscura* male: fore and hind wing (left), and (right, top to bottom) the genitalia on the second abdominal segment in lateral view, the inferior anal appendage in ventral view, and the apex of the abdomen in lateral view. Based on Montgomery (1940).

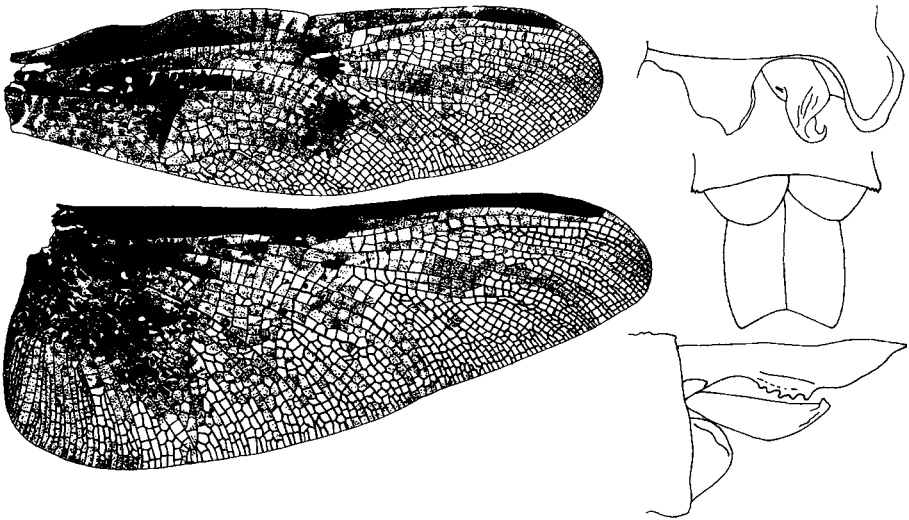


Fig. 3.2.142 *Diastatops nigra* male: fore and hind wing (left), and (right, top to bottom) the genitalia on the second abdominal segment in lateral view, the inferior anal appendage in ventral view, and the apex of the abdomen in lateral view. Based on Montgomery (1940).

5. Areas proximal and distal to the triangle in the fore-wing have secondary reticulation; the veins in these areas are red. The triangle of the fore-wing has 5 to 20 or more cells; that of the hind wing has 4 to more than 20 cells. The upper surface of the frons is red (**Fig. 3.2.139**).

.....*Diastatops estherae* Montgomery, 1940
(Guyana, Venezuela, Amazonas).

- Areas of dense venation and red veins are absent from the fore-wing, and its triangle usually has 3 to 8 cells, while that on the hind wing has 3 to 6 cells (**Fig. 3.2.143**). The upper surface of the frons is brown or metallic purple.6

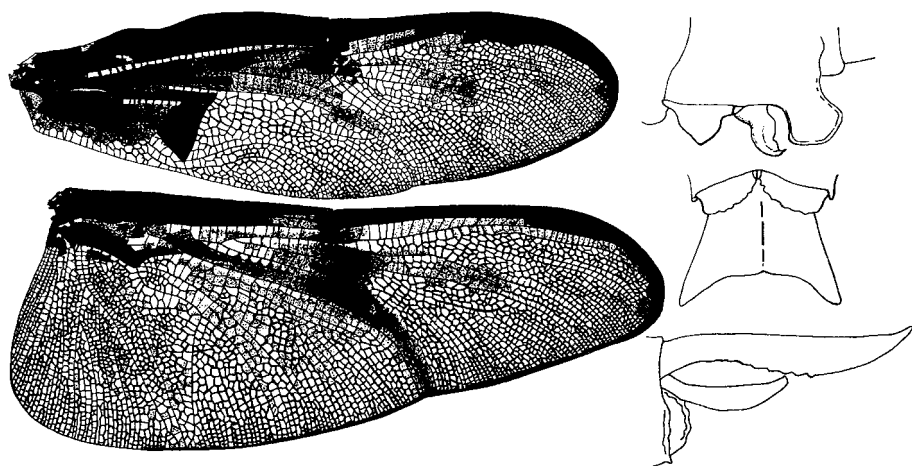


Fig. 3.2.143 *Diastatops pullata* male: fore and hind wing (left), and (right, top to bottom) the genitalia on the second abdominal segment in lateral view, the inferior anal appendage in ventral view, and the apex of the abdomen in lateral view. Based on Montgomery (1940).

6. The wing is 25 mm long or longer. There are usually 18 or more costal antenodal cross veins in the fore-wing and 12 or more in the hind wing. Three or four rows of cells are subtended by Rpl and Mpl. The teeth on the ventral margin of the superior anal appendages are not elevated as a keel (**Fig. 3.2.143**)

.....*Diastatops pullata* (Burmeister, 1939)
(Ecuador, Peru, Venezuela, Guyana, French Guiana, Surinam, Bolivia, Argentina, Pará, Amazonas, Mato Grosso, Pernambuco). Syn: *Libellula pullata* Burmeister, 1939; *Diastatops fuliginea* Rambur, 1842.

- Wing length usually less than 25 mm. There are usually fewer than 18 costal antenodal cross veins in the fore-wing and fewer than 12 in the hind wing. Two rows of cells are subtended by Rpl and Mpl. The superior anal appendages are distinctly keeled ventrally (**Fig. 3.2.144**).7

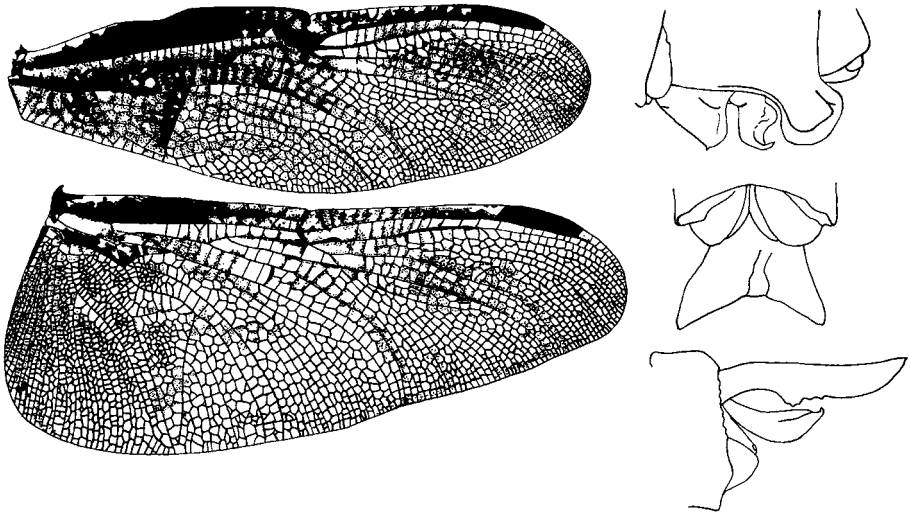


Fig. 3.2.144 *Diastatops emilia* male: fore and hind wing (left), and (right, top to bottom) the genitalia on the second abdominal segment in lateral view, the inferior anal appendage in ventral view, and the apex of the abdomen in lateral view. Based on Montgomery (1940).

7. The area of secondary reticulation in the hind wing is extensive, extending caudad in a loop about 2/3 of the way from the forking of the bisector to the tip of the loop. Veins in this area are dull red and not especially thickened. There are three or four rows of cells in the male and one or two in the female between A_3 and the bisector opposite the fork of A_3 . There are usually not more than two cells between A_1 and the outer branch of the bisector at its origin. Secondary loop or “patella”, if it is formed, contains 35 to 50 cells in the male and 9 to 12 in the female (**Fig. 3.2.144**).

.....*Diastatops emilia* Montgomery, 1940 (Pará).

- The area of secondary reticulation in the hind wing is very dense but not very extensive, extending caudad in a loop less than half way from the forking of the bisector to the tip of the loop. Veins in this area are carmine or bright yellow in teneral specimens and greatly thickened, frequently as broad as the cells enclosed. There are five to seven rows of cells in the male and three in the female between A_3 and the bisector opposite the fork of A_3 . Usually, there are three to six cells in the male and three cells in the female between A_1 and the outer branch of the bisector at its origin. The secondary loop, if it is formed, contains 65 to 140 cells in the male, but rarely fewer than 60, and 21 to 30 in the female (**Fig. 3.2.72**). The head of the male is mainly black and orange, and that of the female is dark brown. The thorax is dark reddish brown,

becoming very dark dorsally in the male. The proximal 1/3 of the male abdomen is reddish brown, and the apical 2/3 is bright red. The abdomen of the females is duller red with a few darker markings. The wings are iridescent black, with a bright carmine patch at the base of the hind wing of the male. On the female hind wing, this area is dusted with a gold color and flecks of carmine.

.....*Diastatops intensa* Montgomery, 1940
(Peru, Paraguay, Argentina, Uruguay, Pará, Mato Grosso, Mato Grosso do Sul, São Paulo, Rio de Janeiro, Rio Grande do Sul).

Key to the species of adult *Zenithoptera* in South America

Information for the key was provided by Santos (1941) and Jurzitza (1982b). Not enough information is available to prepare a key for the larvae.

1. The lateral surface of the thorax is dark brown with five narrow, irregular, brownish yellow bands. The apices of the blackish, strongly iridescent wings are entirely dark, or only a very small lighter area is present at the apex of the fore-wing. There is usually a narrow lighter band from the anterior margin just distal to the nodus to near the posterior margin (Fig. 3.2.73). The abdomen is dark brown with narrow yellowish bands along the posterior margins of the segments.

.....*Zenithoptera fasciata* (Linnaeus, 1758)
(Central America, Trinidad, Colombia, Ecuador, Peru, Venezuela, Guyana, French Guiana, Surinam, Mato Grosso). Syn: *Libellula fasciata* Linnaeus, 1758; *Libellula americana* Linnaeus, 1758; *Libellula violacea* De Geer, 1773.

- There are two broad, light markings on the lateral surface of the male thorax, and sometimes one other narrow marking. The apex of the fore-wing has a lighter area near or at the apex that encompasses almost the entire width of the wing (Fig. 3.2.145).2



Fig. 3.2.145 *Zenithoptera lanei* male (left to right): light and dark pattern on the fore and hind wings, color pattern on the lateral surface of the thorax, penis in ventral (above) and lateral view (below thorax), and superior anal appendage in lateral view (right). Based on Jurzitza (1982b).

2. There is a narrow amber antehumeral band visible on the dark brown lateral surface of the thorax and a light marking near the apex of both the fore and hind wing that usually does not reach the apex (**Fig. 3.2.145**). The abdomen is brown to dark brown with narrow yellowish bands along the posterior margins of the segments. Length of male abdomen: c. 16.5 mm; female: c. 13 mm. Hind wing length: 20.5 to 21 mm. Length of pterostigma on fore-wing: 4.0 to 4.1 mm. Coloration: generally black or blackish with iridescent areas, yellow lateral stripes on the abdomen, and wings generally darkly clouded with gray or blue and strongly contrasting hyaline areas. Male chromosome number: $2n = 25$, $n = 13$ (Ferreira *et al.*, 1979).

..... *Zenithoptera lanei* Santos, 1941
(Peru, Venezuela, Paraguay, Argentina, São Paulo).

- There is no narrow antehumeral band visible on the lateral surface of the thorax and a light marking covering much of the apex of the fore-wing, but the hind wing is entirely dark from the light middle band to the apex (**Fig. 3.2.146**).

..... *Zenithoptera viola* Ris, 1910
(Venezuela, French Guiana, Paraguay, Mato Grosso, São Paulo).

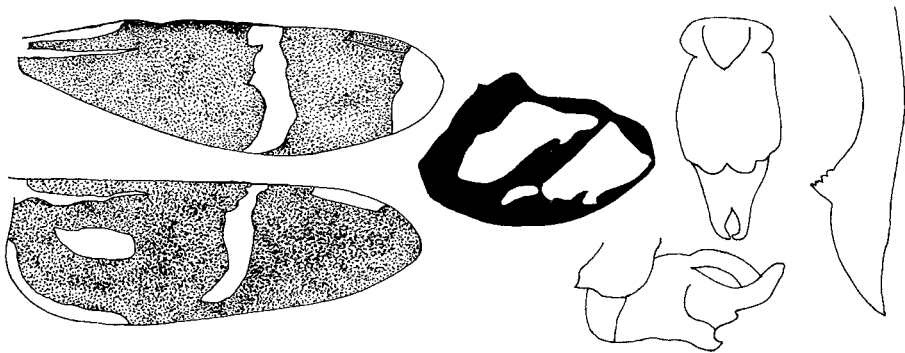


Fig. 3.2.146 *Zenithoptera viola* male (left to right): light and dark pattern on the fore and hind wings, color pattern on the lateral surface of the thorax, penis in ventral (above) and lateral view (below), and superior anal appendage in lateral view (right). Based on Jurzitza (1982b).

Key to the species of adult *Perithemis* in South America

Information for the key provided by Ris, (1930), Santos (1973c), Hoffmann (1991), and von Ellenrieder and Muzón (1999). The markings on the wings of most *Perithemis* species are multicolored and extremely variable. Those illustrated are mainly those with relatively little darkening to make the veins more evident. Often, it is very difficult to discern the veins, even of living and well-preserved specimens. Only those patterns mentioned in the keys should be considered since there may be much overlap among the species in other features.

1. The wings of the male are yellowish with golden brown veins as far as the dark grayish brown pterostigma and hyaline with dark brown veins from there to the apices. The hind wing of the male is 2.2 times as long as the width at the base. The thorax of the male is brownish yellow tinged greenish in places and with very narrow reddish brown margins of the sutures. The hamules are strongly curved and blackened at the apices (**Fig. 3.2.147**). Length of male abdomen: 12.8 to 13.0 mm. Hind wing length of male: 17.2 to 17.5 mm. Coloration: head brownish and greyish yellow with brown and black setae. Abdomen: Reddish brown with blackish markings on the eighth through tenth segments. The female has not been described.

.....*Perithemis parzefalli* Hoffmann, 1991 (Ecuador, Peru). This species should be redescribed. The characters earlier authors relied upon to distinguish the *Perithemis* species have not been described, and, although they might not be fully reliable, they must be depended upon until a comprehensive revision of the genus provides better ones.

- The wings of the male usually are strongly marked in various colors, while those of the female may be only tinted. The hind wing is longer than 2.2 times its basal width, or the male thorax has one or two dark stripes along the sutures (**Fig. 3.2.148**).2

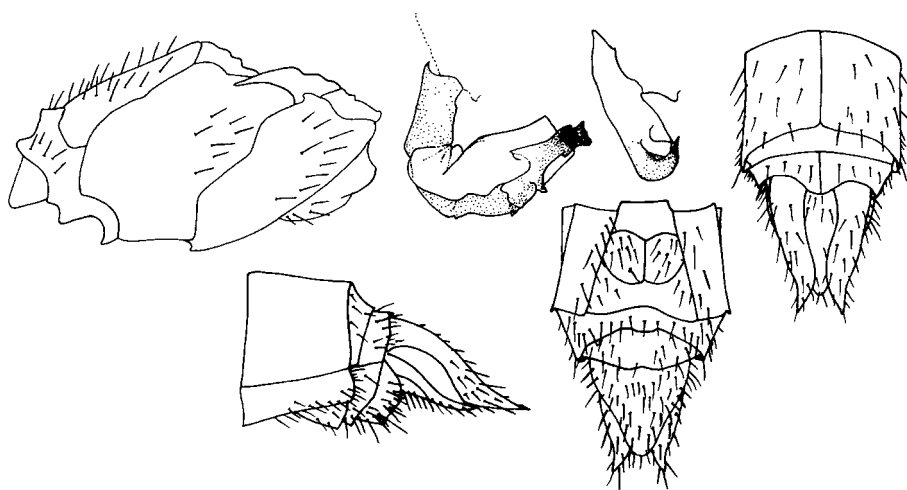


Fig. 3.2.147 *Perithemis parzefalli* male (above, left to right): thorax in lateral view showing the arrangement of the setae, penis in lateral view, hamule, apex of the abdomen in dorsal view and (below) in lateral (left) and ventral view (right). Based on Hoffmann (1991).

2. All triangles and subtriangles free. There are two dark stripes on the sutures of the synthorax. The vulvar lamina is has a cleft V-shape with divergent lobes (**Fig. 3.2.148**).3

- At least one of the triangles or subtriangles crossed. There is only one antehumeral dark stripe on the synthorax. The vulvar lamina is has a cleft U-shape with parallel lobes (**Fig. 3.2.149**).4

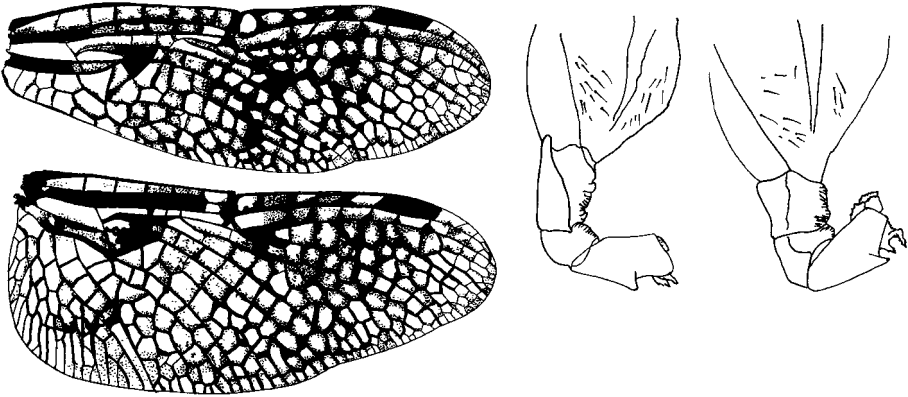


Fig. 3.2.148 Fore and hind wing of a relatively old male of *Perithemis lais* (left), in which the typical solid bands have broken up, and the penises of two individuals open to different degrees in lateral view (center and right). Based on Ris (1930).

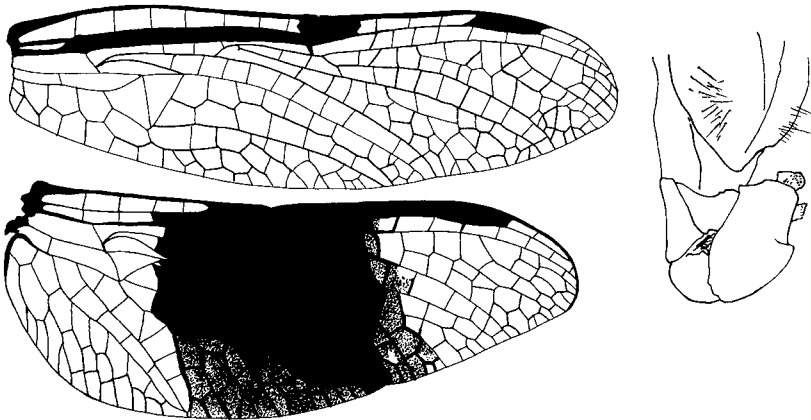


Fig. 3.2.149 *Perithemis bella*: fore and hind wing of a female (left) and the penis in lateral view (right). Based on Ris (1930).

3. The thorax has a sharply defined pattern of whitish or greenish yellow and golden brown bands. Typically, there are two narrow, curved brown bands on wings, the proximal one across the triangles, the distal one from the origin of the

bridge to the end of Cu_2 in the fore-wing and the apex of the loop in the hind wing. In older individuals, these solid bands break up somewhat (**Fig. 3.2.148**). The pattern is on a golden yellow ground color in the male and on a hyaline background in the female. Male chromosome number: $2n = 17$, $n = 9$ (Ferreira *et al.*, 1979).

.....*Perithemis lais* (Perty, 1834)
(Trinidad, Colombia, Ecuador, Peru, Venezuela, Guyana, French Guiana, Bolivia, Argentina, São Paulo, Pará, Amazonas, Mato Grosso, Mato Grosso do Sul). Syn: *Libellula lais* Perty, 1834; *Perithemis naitas* (Ris, 1910); *Perithemis tenera* (non Say, 1839) Fraser (1947a) misidentified.

- The thorax is purplish brown on the dorsum, sometimes with diffuse, dull greenish antehumeral bands. Laterally, it is uniformly light ochraceous brown or has diffuse clouding above the metastigma. Wings of the male are golden yellow with red veins and pterostigmas. Rarely, there are dull spots at the triangles. The wings of the female are hyaline with very variable markings. The tarsi are light ochraceous yellow with black spines (**Fig. 3.2.150**). Male chromosome number: $2n = 25$, $n = 13$ (Ferreira *et al.*, 1979).

.....*Perithemis mooma* Kirby, 1889
(Mexico, Central America, West Indies, Colombia, Ecuador, Peru, Venezuela, Guyana, French Guiana, Bolivia, Paraguay, Argentina, Uruguay, Minas Gerais, São Paulo, Rio de Janeiro, Santa Catarina, Mato Grosso do Sul, Mato Grosso). Syn: *Perithemis cloe* Hagen, 1861 (*nomen nudum*); *Perithemis peperi* Hoffmann, 1987; *Perithemis mooma* var. *octoxantha* Ris, 1910. There are two similar North American species: *Perithemis seminole* (Calvert, 1907) and *Perithemis tenera* (Say, 1839). They are distinguished by their two distinct dull green bands on the mesepimeron and metepimeron.

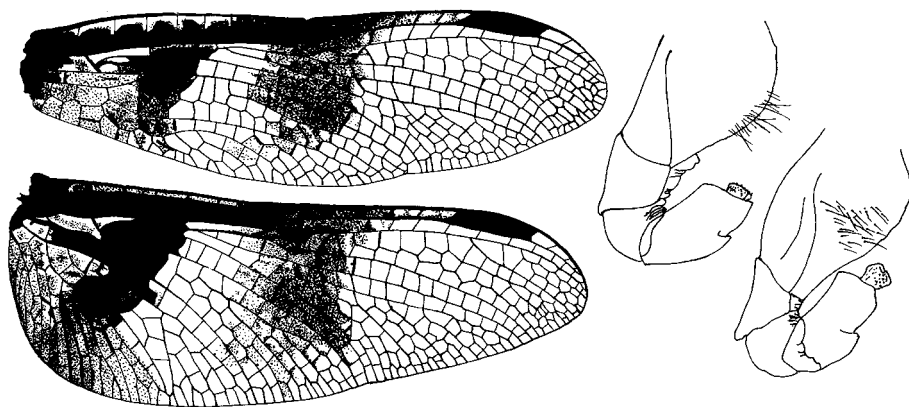


Fig. 3.2.150 Fore and hind wing of a female *Perithemis mooma* (left) and the penises of two individuals in lateral view (center and right). Based on Ris (1930).

4. Subtriangles in fore-wings of males with two or three cells; those of females are free. Abdomen robust, that of female spindle-shaped. Legs dark except for a light yellow stripe on the extensor side of the tibiae. Wings of male mainly golden yellow, but fore-wing has a dark transverse basal band extending distally about 1/4 of the wing length and joining a thin dark anterior stripe running along the costal and subcostal fields to the area of the pterostigma; wings of female hyaline with yellow, brown and yellow, or brown in the subcostal cell and in the costal cell near the nodus of the fore-wing; a yellow transverse band with a black center proximal to the pterostigma in the hind wing (**Fig. 3.2.149**).

.....*Perithemis bella* Kirby, 1889
(Ecuador, Peru, Pará, Amazonas). Syn: *Perithemis austeni* Kirby, 1897.

- Wing venation the same in both sexes. Subtriangles in fore-wings of females have two or three cells, and those of males either have no extensive dark areas, one or more dark transverse bands near the middle, or a dark basal area extending at least about halfway from the base to the apex.5

5. The triangles in both wings are free. The subtriangle in the fore-wing has two cells. The abdomen is narrow with parallel borders (**Fig. 3.2.151**).6

- The triangle is usually crossed, at least in the hind wing. Subtriangles in the fore-wing have two or three cells (**Fig. 3.2.152**).7

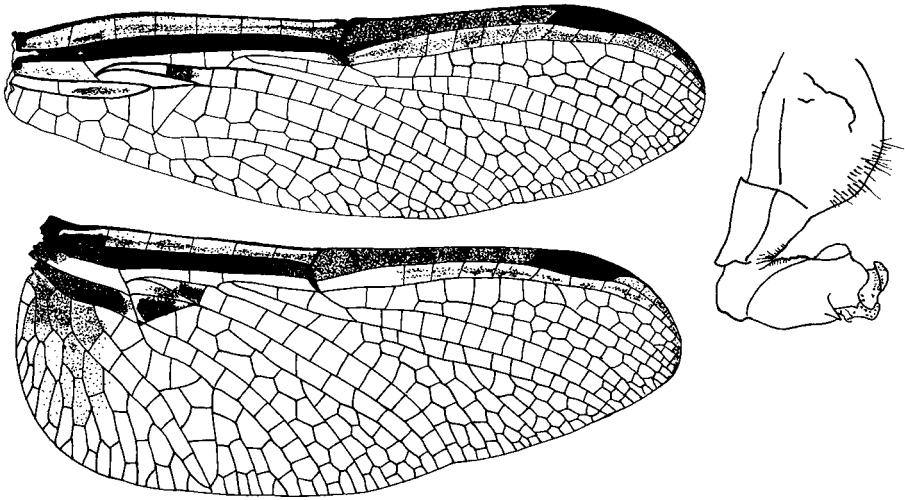


Fig. 3.2.151 Fore and hind wing of a male *Perithemis domitia* (left) and penis in lateral view (right). Based on Ris (1930).

6. The legs are dark brown with light yellow markings on the flexor side of the fore-femur and the extensor side of all tibiae. The thorax is purplish brown on the dorsum with somewhat diffuse greenish antehumeral stripes and dull olive

green with incomplete brownish bands laterally. There are complete brownish black longitudinal bands on each side of abdominal tergites 4 to 9 (**Fig. 3.2.151**).

.....*Perithemis domitia* (Drury, 1773)
(North and Central America, West Indies, Colombia, Venezuela, Ecuador, Peru, São Paulo). Syn: *Libellula domitia* Drury, 1773; *Libellula metella* Selys in Sagra, 1857; *Perithemis pocahontas* Kirby, 1889; *Perithemis domitia* var. *iris* Hagen, 1861.

Reports of this species from Argentina seem to be based on misidentifications of *Perithemis mooma*.

- The legs are entirely light yellow. Thorax very light golden brown dorsally and greenish laterally without dark markings. The basal segments of the abdomen nearly unmarked; tergites 7 through 9 each have a narrow oblique dark stripe. The hind wing is widest near the base (**Fig. 3.2.71**).

.....*Perithemis electra* Ris, 1930
(Central America, Trinidad, Colombia, Ecuador, Peru, Venezuela, French Guiana, Paraguay, Bolivia, Mato Grosso).

7. The triangles in both wings and the subtriangle in the fore-wing are usually crossed (**Fig. 3.2.152**).8

- The triangle in the fore-wing is free, but it is usually crossed in hind wing. The subtriangle in the fore-wing usually has two cells, but it sometimes has three (**Fig. 3.2.153**).10

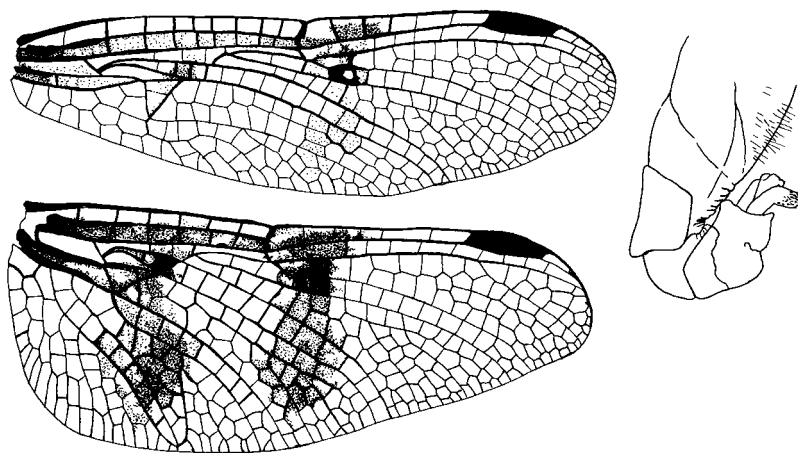


Fig. 3.2.152 Fore and hind wing of a female *Perithemis icteropectera* (left) and penis in lateral view (center and right). Based on Ris (1930).

8. The male has reddish orange wings, and the wings of the female are orange. All have dark brown in the subcostal space, along a complete band distal to the nodus, and on a spot at the distal edge of the triangle. The hind wing also has a dark brown marking extending from the angle of the anal loop nearly to the

proximal posterior border. The veins proximal to the pterostigma are orange or red (**Fig. 3.2.154**). Total length: 18.0 to 19.7 mm. Length of abdomen: 10.5 to 12 mm. Hind wing length: 16 to 17.5 mm. The range applies to both sexes.

.....*Perithemis rubita* Dunkle, 1982
(Ecuador).

- The wing membrane is yellow, and the veins range from yellow to black. The color is paler in the space running from the triangle to the nodus (**Fig. 3.2.152**). If there is brown on the wing, it is not very dark.9

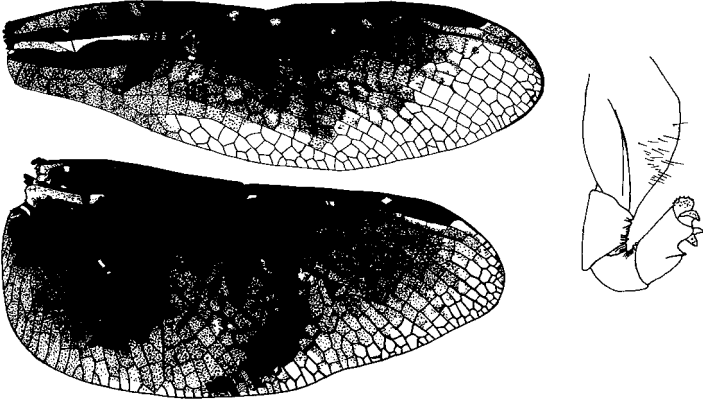


Fig. 3.2.153 Fore and hind wing of a male *Perithemis cornelia* (left) and the penis in lateral view (right). Based on Ris (1930).

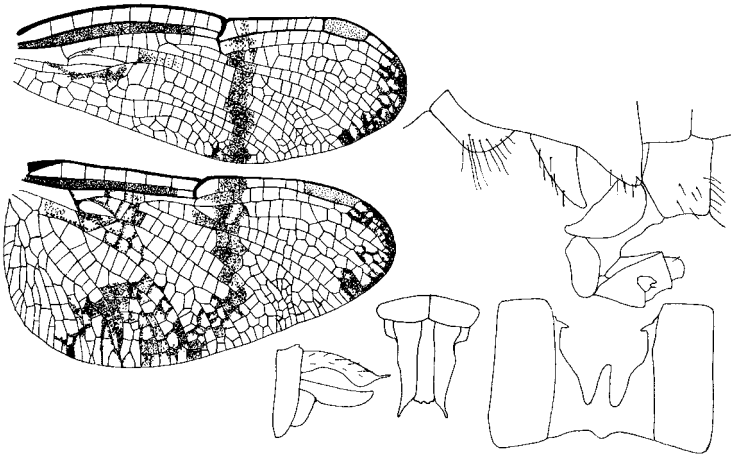


Fig. 3.2.154 *Perithemis rubita*: fore and hind wing (left), genitalia of the male on the second abdominal segment in lateral view (upper right), apex of the male abdomen in dorsal (lower right center) and lateral view (lower center), and a portion of the ninth abdominal segment of a female in ventral view showing the shape of the subgenital plate (lower right). Based on Dunkle (1982).

9. The wings of the male and female are similar in color: golden yellow, sometimes with darker spots, and with the veins varying from dark ferrugineous to light yellow (**Fig. 3.2.152**). Labrum, labium, anteclypeus, and postclypeus light grayish green. The center of the frons is dull yellow or orange. Male chromosome number: $2n = 25$, $n = 13$ (Mola and Agopian, 1985).

.....*Perithemis icteroptera* (Selys in Sagra, 1857) (Argentina, São Paulo, Rio de Janeiro). Syn: *Libellula icteroptera* Selys in Sagra, 1857; *Perithemis waltheri* Ris, 1910.

- The wings of the male, both veins and membranes, are golden yellow, sometimes with blackish spots on the triangles. The wings of the females are hyaline with narrow to broad dark distal bands in about the same location of both fore and hind wings (**Fig. 3.2.72**).

.....*Perithemis intensa* Kirby, 1889 (North America, Colombia, Venezuela).

10. Narrow dark oblique stripes on abdominal tergites 4 through 9, developed in females to dark longitudinal stripes. Wings of males golden yellow with variable dark markings at the triangles and distal to the nodus. Females with more dark markings on light yellow wings, which are hyaline at the base of the fore-wing and tip of the hind wing (**Fig. 3.2.153**).

.....*Perithemis cornelia* Ris, 1910 (French Guiana, Venezuela, Ecuador, Peru, Bolivia, Amazonas, Mato Grosso).

- Males and females both with complete blackish longitudinal stripes on the abdomen. Wings of both sexes light golden yellow with sharply defined blackish transverse bands, the most distal one at the nodus and the most proximal one, which is often incomplete or interrupted, at the triangles of both fore and hind wings (**Fig. 3.2.155**).

.....*Perithemis thais* Kirby, 1889 (Costa Rica, Trinidad, Ecuador, Peru, Venezuela, Guyana, French Guiana, Paraguay?, Argentina, São Paulo, Pará, Amazonas, Mato Grosso).



Fig. 3.2.155 *Perithemis thais*: fore and hind wing of a female (left) and the penis in lateral view (right). Based on Ris (1930).

Key to the species of known larval *Perithemis* in South America

Information for the key was provided by von Ellenrieder and Muzón (1999), Spindola *et al.* (2001), and Costa and Régis (2005).

1. There are six or occasionally five setae on the labial palp (**Fig. 3.2.156**).2
 - There are four or fewer setae on the labial palp (**Fig. 3.2.157**).4
2. The shape of the abdomen is oval. The cerci are about half as long as the epiproct. There are 11 premental setae (**Fig. 3.2.158**). Total length: 14 to 15 mm.*Perithemis domitia* (Drury, 1773) (North and Central America, West Indies, Colombia, Venezuela, Ecuador, Peru, São Paulo). Syn: *Libellula domitia* Drury, 1773; *Libellula metella* Selys in Sagra, 1857; *Perithemis pocahontas* Kirby, 1889; *Perithemis domitia* var. *iris* Hagen, 1861.
 - The abdomen is cylindrical in shape. The cerci are $\frac{3}{4}$ as long the epiproct (**Fig. 3.2.156**).3

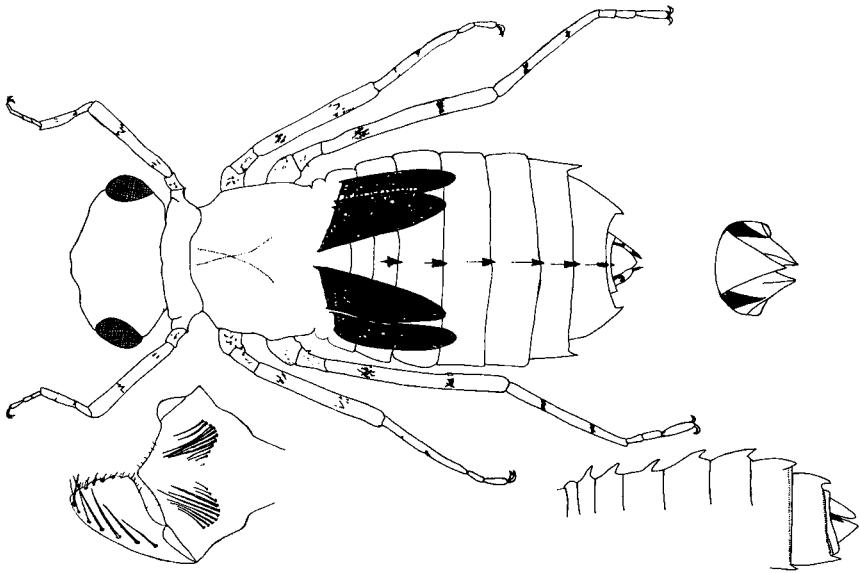


Fig. 3.2.156 *Perithemis electra* larva: habitus (upper left), labium with one lobe in dorsal view (lower left), lateral profile of the abdomen (lower right), and apex of the abdomen in dorsal view (middle right). Based on Santos (1970a).

3. There are 11 premental setae. Most of the teeth on the mandibles are tapered to a rounded apex. The dorsal hook on the ninth abdominal segment extends over nearly the entire length of the tenth segment (**Fig. 3.2.159**). Total length: 13 to 13.5 mm.

.....*Perithemis icteropecta* (Selys in Sagra, 1857)
(Argentina, São Paulo, Rio de Janeiro). Syn: *Libellula icteropecta* Selys in
Sagra, 1857; *Perithemis waltheri* Ris, 1910.

- There are 10 premental setae (**Fig. 3.2.156**). Total length: c. 12 mm.

.....*Perithemis electra* Ris, 1930
(Central America, Trinidad, Colombia, Ecuador, Peru, Venezuela, French
Guiana, Paraguay, Bolivia, Mato Grosso).

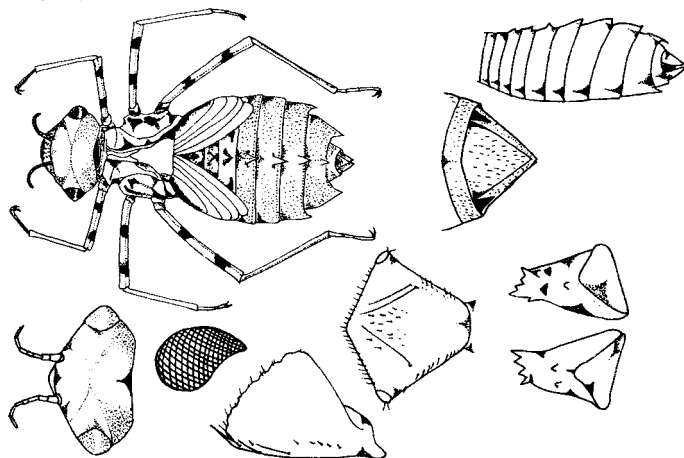


Fig. 3.2.157 *Perithemis lais* final larval instar: habitus (upper left), outline of the dorsal surface of the abdomen in lateral view (upper right), apex of the abdomen in dorsal view (upper middle right), head in dorsal view (lower left), compound eye (lower left center), prementum (lower right center) and labial palp in dorsal view (lower center), and mandibles in posterior view (lower right). Based on Carvalho *et al.* (2005).

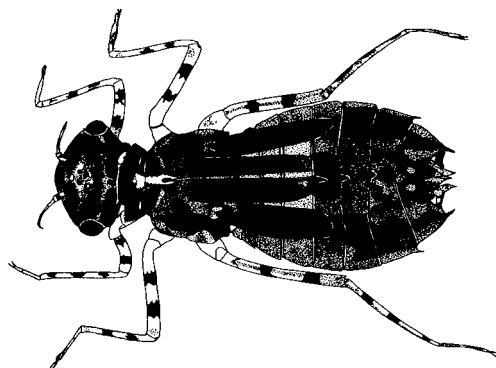


Fig. 3.2.158 Habitus of a *Perithemis domitia* larva. Based on Needham *et al.* (2000).

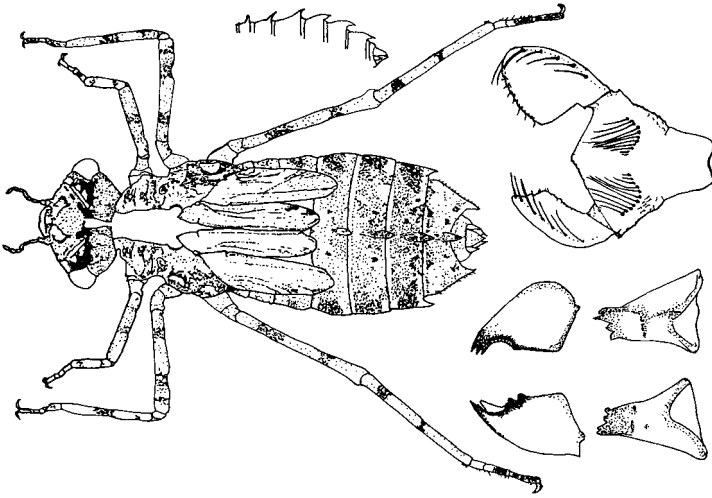


Fig. 3.2.159 *Perithemis icteropectera* final larval instar: habitus (left), lateral profile of the dorsal surface of the abdomen (upper center), prementum and labial palps in dorsal view (upper right), mandibles in posterior (lower right center) and inner view (lower right). Based on von Ellenrieder and Muzón (1999).

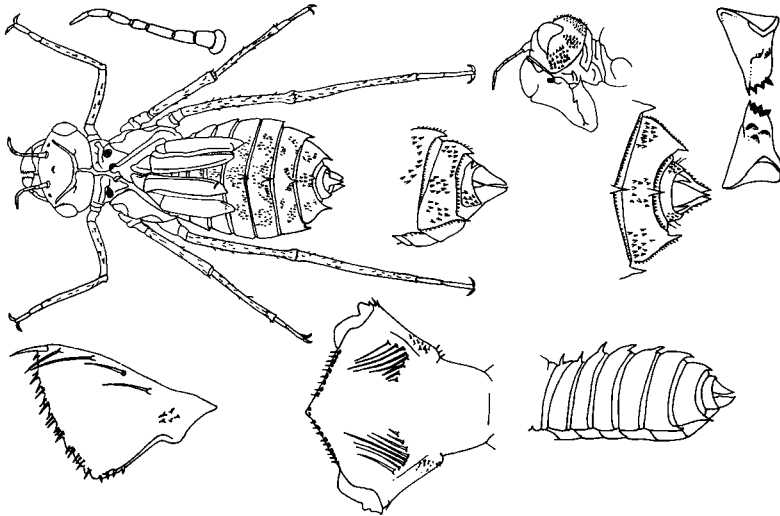


Fig. 3.2.160 *Perithemis thais* larva: habitus of an exuvia (middle left), antenna (upper left), head in lateral view (upper right center), mandibles (upper right), labial palp (lower left), prementum in dorsal view (lower center), lateral profile of the abdomen (lower right), and apex of the abdomen in lateral (center) and dorsal view (middle right). Based on Spindola *et al.* (2001).

4. There are three palpal setae posterior to the moveable hook and one or two premental setae. The cerci are about $\frac{1}{4}$ as long as the epiproct (**Fig. 3.2.157**). Total length: 11.5 to 12.0 mm.

.....*Perithemis lais* (Perty, 1834)
(Trinidad, Colombia, Ecuador, Peru, Venezuela, Guyana, French Guiana, Bolivia, Argentina, São Paulo, Pará, Amazonas, Mato Grosso, Mato Grosso do Sul). Syn: *Libellula lais* Perty, 1834; *Perithemis naias* (Ris, 1910); *Perithemis tenera* (non Say, 1839) Fraser (1947a) misidentified.

- There are four palpal setae and at least eight premental setae. The cerci are about half as long as the epiproct (**Fig. 3.2.160**). The larvae reach at least about 12.5 mm in length.5

5. The prementum is slightly wider than long, and when retracted, it reaches the bases of the middle legs. Total length: c. 13.0 mm. The number of premental setae varies from 7 to 12. Most of the teeth on the mandibles are strong and pointed. The dorsal hook on the ninth abdominal segment extends over about half the length of the tenth segment (**Fig. 3.2.127**). Male chromosome number: $2n = 25$, $n = 13$ (Ferreira *et al.*, 1979).

.....*Perithemis mooma* Kirby, 1889
(Mexico, Central America, West Indies, Colombia, Ecuador, Peru, Venezuela, Guyana, French Guiana, Bolivia, Paraguay, Argentina, Uruguay, Minas Gerais, São Paulo, Rio de Janeiro, Santa Catarina, Mato Grosso do Sul, Mato Grosso). Syn: *Perithemis cloe* Hagen, 1861 (*nomen nudum*); *Perithemis peperi* Hoffmann, 1987; *Perithemis mooma* var. *octoxantha* Ris, 1910.

- The prementum is approximately as long as wide, and when retracted, it reaches only to the bases of the fore-legs (**Fig. 3.2.160**). Total length: c. 12.5 mm.

.....*Perithemis thais* Kirby, 1889
(Costa Rica, Trinidad, Ecuador, Peru, Venezuela, Guyana, French Guiana, Paraguay?, Argentina, São Paulo, Rio de Janeiro, Espírito Santo, Pará, Amazonas, Mato Grosso, Mato Grosso do Sul).

Key to the species of adult male *Antidythemis* in South America

Information for the key obtained from Buchholtz (1952).

1. The dorsal surface of the male thorax is black, and the abdomen is matt black with brown rings at the posterior margins of the fourth through ninth segments and brown edges on the tenth segment. The bases of the elevations on the ventral side of the penis that bear the long processes are separated by a groove (**Fig. 3.2.74**). Length of male abdomen including appendages: c. 32 mm. Hind wing length of male: c. 46 mm. The female has not been described.

.....*Antidythemis nigra* Buchholtz, 1952
(Venezuela).

- The dorsal surface of the male thorax is light reddish brown with some greenish blue reflections. The abdomen of the male is mainly light reddish brown with black posterior rings on the fourth through ninth segments and black dorsal surfaces of the eighth through tenth segments. The bases of the elevations on the ventral side of the penis that bear the long processes are in contact (**Fig. 3.2.161**). Length of male abdomen including appendages: c. 33.5 mm. Hind wing length of male: c. 47 mm.

.....*Antidythemis trameiformis* Kirby, 1889
(French Guiana, Bolivia, Brazil). The great similarity of these two species in all features except for the coloration suggests that they may be merely geographical variants of a single species.

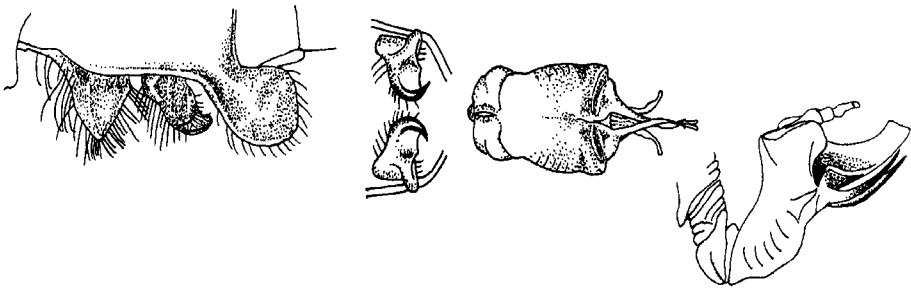


Fig. 3.2.161 *Antidythemis trameiformis* male (left to right): genitalia on the second abdominal segment in lateral view, the hamuli in ventral view, and the penis in ventral and lateral view. Based on Buchholz (1952).

Key to the species of adult *Erythemis* in South America

Information for the key was provided by Williamson (1923a).

1. The first three abdominal segments considerably widen laterally, have blister-like extensions, and are also expanded dorsoventrally. The fourth through tenth segments are elongated and have roughly parallel sides. The fore-wing has $12\frac{1}{2}$ or more antenodal cross veins. R_3 runs in the form of a single, moderately convex curve. There are two rows of cells in $IR_3 - Rspl$. Three discoidal cells border on the triangle. The discoidal area on the fore-wing is parallel-sided and moderately expanded toward the edge of the wing. The pterostigma is large (**Fig. 3.2.162**). Length of hind wing: 35 to 41 mm. The head and thorax are mainly light green with light brown borders to the sutures and reddish brown compound eyes. The first seven abdominal segments are green with blackish markings on the posterior parts of the fourth through seventh segments. The eighth through tenth segments are black, and the anal appendages are yellowish

and light brown. The femora and pterostigma are brown. Male chromosome number: $2n = 25$, $n = 13$ (Ferreira *et al.*, 1979).

.....*Erythemis vesiculosa* (Fabricius, 1775)
(North America, Central America, West Indies, Colombia, Venezuela, French Guiana, Guyana, Surinam, Ecuador, Peru, Bolivia, Paraguay, Argentina, Mato Grosso, Mato Grosso do Sul, Rio de Janeiro, São Paulo). Syn: *Libellula vesiculosa* Fabricius, 1775; *Libellula acuta* Say; *Lepthemis vesiculosa* (Fabricius, 1775).

- The first three abdominal segments are only moderately widened; in case of doubt, one or more of the other characters are not present (**Fig. 3.2.163**).2
2. Measured along the apical carina, the apices of the lateral and ventral carinas of the third abdominal segment are no more than 0.8 mm apart. The distance between these carinas measured opposite the junction of the lateral and median transverse carinas is at least 1.5 times the distance between their apices. The lateral and ventral carinas on the fourth abdominal segment are usually separated by a distance less than 1/6 the length of the lateral carina on that segment. The ventral teeth on the superior appendages of the male extend posteriad beyond the level of the apex of the inferior appendage (**Fig. 3.2.163**).

.....3
- Measured along the apical carina, the apices of the lateral and ventral carinas of the third abdominal segment are at least 1 mm apart. The distance between these carinas measured opposite the junction of the lateral and median transverse carinas is no more than 1.5 times the distance between their apices. The lateral and ventral carinas on the fourth abdominal segment are usually separated by a distance greater than 1/6 the length of the lateral carina on that segment. The legs are mainly black or dark brown. The penis is widest in lateral view just proximal to its apex (**Fig. 3.2.164**).6

3. The length of the abdomen is less than 30 mm, which is shorter than the hind wings. The thorax has a distinct dorsal pattern, the dorsum being pale and bordered by black laterally with antehumeral or pleural marks. The insects are mainly yellowish, greenish, or black. The male is usually nearly black, while the female usually has numerous lighter markings. The external branch of the hamule of the male is triangular with its posteroventral edge longer than the distance between the apex of the internal branch and the anteroventral angle of the external branch. The median lobe of the penis is relatively thick at the apex (**Fig. 3.2.165**). The lamina of the female is short. The wings are hyaline, and the pterostigma is pale yellow, sometimes with darker margins.

.....*Erythemis credula* (Hagen, 1861)
(West Indies, Panama, Colombia, Venezuela, French Guiana, Guyana, Surinam, Bolivia, Argentina, Mato Grosso, Mato Grosso do Sul, São Paulo). Syn: *Diplax credula* Hagen, 1861.

- The abdomen is at least 30 mm long. The external branch of the male hamule is rounded with its posterior edge equal to or shorter than the distance between the apex of the internal branch and the anteroventral angle of the external branch (**Fig. 3.2.163**).4

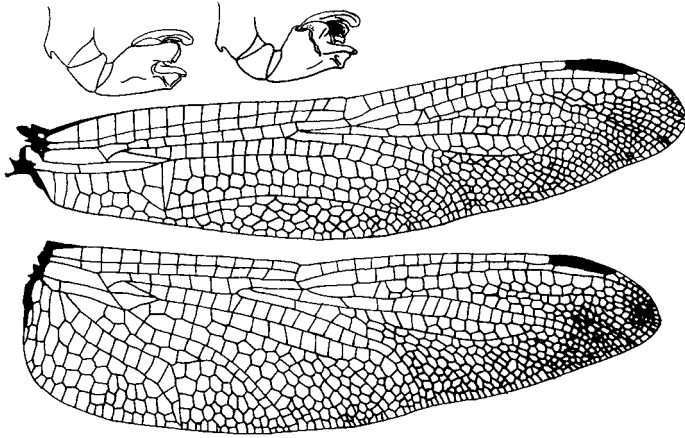


Fig. 3.2.162: *Erythemis vesiculosa*: fore and hind wing (below), penis in lateral view (upper left) and a similar view with the lateral lobe removed to show the internal structures (upper right). Based on Williamson (1923a) and Kennedy (1923).



Fig. 3.2.163 *Erythemis carmelita* (upper row, left to right): outline of the genitalia on the second abdominal segment of the male in lateral view, and the vulvar lamina of the female in lateral view, and (lower row, left to right): the genitalia on the second abdominal segment of the male in lateroventral view, the penis in lateral view with the lateral lobe removed to reveal the internal structure, the inferior anal appendage of the male in ventral view, and the vulvar lamina of a female in anteroventral view. Based on Williamson (1923a).



Fig. 3.2.164 *Erythemis peruviana*: penis in lateral view without (left) and with the lateral lobe removed to show internal structures (right). Based on Kennedy (1923).



Fig. 3.2.165: *Erythemis credula*: penis in lateral view without (left) and with the lateral lobe removed to show internal structures (right). Based on Kennedy (1923).

4. The legs are mainly pale. The hind wings are longer than the abdomen. The thorax has no distinct pattern. The insects are yellowish, greenish, or red. The lamina of the female is distinctly bent so that the apical lobe is directed caudad, and in lateral view, there is a deep posterior emargination between the basal lobes and the apex. It is about 0.9 mm from the apex to the base of the basal lobe of the lamina. The apex of the ninth abdominal sternite bears a sparse patch of bristle-like setae (**Fig. 3.2.163**). The darkened area at the base of the hind wing is dark yellow to reddish brown, and the remainder of the wings is hyaline. The pterostigma is opaque gray with darker margins.

.....*Erythemis carmelita* Williamson, 1923
(Colombia, Peru, Venezuela, Amazonas, Mato Grosso do Sul).

- Much of the tibiae and parts of the femora are black or brown. The abdomen and hind wings are about equal in length. The lamina of the female is trough-shaped and projects ventrad with its apex neither distinctly bent nor directed caudad (**Fig. 3.2.166**).5

5. The dorsal color pattern includes predominantly dark on the fifth through tenth abdominal segments and a distinct pattern on the thorax, including pale in the middle and black pleurae or a black antehumeral band. The general coloration is yellowish, greenish, or black, with or without markings on the abdomen. The anal appendages are pale. The external branch of the hamule is directed ventrad and, in posterior view, erect. The lamina of the female is 1.5 mm from the base of the basal lobe to the apex. The apex of the ninth sternite bears a patch or single transverse row of sparse bristles. The apical segment of the penis in lateral view appears widest near its midlength (**Fig. 3.2.166**).

.....*Erythemis plebeja* (Burmeister, 1839)
(North and Central America, West Indies, Colombia, Venezuela, French Guiana, Guyana, Surinam, Ecuador, Peru, Bolivia, Paraguay, Argentina, Rio de Janeiro, São Paulo, Mato Grosso do Sul). Syn: *Libellula plebeja* Burmeister, 1839; *Leptemis verbenata* Hagen, 1861.

- The abdominal segments are mainly light reddish dorsally, bright red in the male and somewhat orange or brownish in the female. The thorax does not have a distinct dorsal pattern and is usually reddish brown in the male and yellowish in the female, although the general coloration may vary from yellowish green to red. The external branch of the hamule is directed more caudad than ventrad and, in posterior view, not erect. The apicalmost process of the penis curves

sharply dorsad (**Fig. 3.2.167**). The wings are hyaline, and the pterostigma varies from black to light grayish with a dark border. The heads of both sexes are usually black with dark compound eyes. The lamina of the female is 0.75 mm from the base of the basal lobe to the apex. The apex of the ninth sternite bears a single row or patch of sparse bristles.

.....*Erythemis haematogastra* (Burmeister, 1839)
(Panama, West Indies, Colombia, Ecuador, Peru, Venezuela, French Guiana, Guyana, Surinam, Argentina, Paraguay, Mato Grosso do Sul, Mato Grosso, Pará). Syn: *Libellula haematogastra* Burmeister, 1839.



Fig. 3.2.166 Penis of *Erythemis plebeja* in lateral view (left) and a similar view with the lateral lobe removed to show the internal structures. Based on Kennedy (1923).

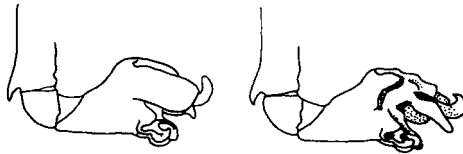


Fig. 3.2.167 Penis of *Erythemis haematogastra* in lateral view (left) and a similar view with the lateral lobe removed to show the internal structures. Based on Kennedy (1923).

6. The labrum, face, and frons are green and yellow. The wing bases are unmarked, or, at most, the hind wings are tinged basally with yellow. The thorax lacks a definite pattern, being a green, yellowish green, or dark pruinose color. The ventral teeth of the male superior appendages extend posteriad beyond the apices of the inferior appendages. The external branch of the hamule is directed more caudad than ventrad, and the genital lobes reach ventrad far beyond the hamules. The lamina of the female is 1.25 mm from the base to the apex and has a rounded triangular shape in anteroventral view. In lateral view, the posterior basal lobe is scarcely evident. The apex of the ninth sternite bears a single or a double row of bristles (**Fig. 3.2.75**).

7 - The labrum, face, and frons are not green or yellow. The wing bases are distinctly darkened or, at least, tinged with yellow. The thorax is green, greenish yellow, red, or black. The ventral teeth of the male superior appendages extend posteriad only as far as the apices of the inferior appendages. The external branch of the hamule is directed more ventrocaudad, extending ventrad about as far or farther than the genital lobes. The lamina of the female, if triangular, is

swollen at the base on either side, in anteroventral view. In lateral view, the posterior basal lobe is distinct. The apex of the ninth sternite of most species bears a patch of bristles (**Fig. 3.2.164**).8
 7. The lateral and ventral carinae of the fourth abdominal segment are separated by a distance about $\frac{1}{5}$ the length of the lateral carina. The pterostigma tends to be clearer in the center (**Fig. 3.2.75**).

.....*Erythemis simplicicollis* Say, 1839)
 (North America, West Indies).

- The lateral and ventral carinas of the fourth abdominal segment is separated by a distance about $\frac{1}{3}$ the length of the lateral carina.

.....*Erythemis collocata* (Hagen, 1861)
 (North America).

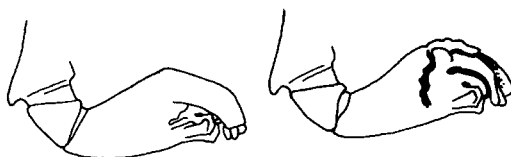


Fig. 3.2.168 Penis of *Erythemis attala* in lateral view (left) and a similar view with the lateral lobe removed to show the internal structures. Based on Kennedy (1923).

8. The dark basal cloud on the hind wing does not reach the cubito-anal cross vein. The thorax is usually distinctly patterned with a dorsomedian rectangular pale area bordered by black laterally, but old males become entirely black on the thorax and bright red on the fourth through tenth abdominal segments. Females are dirty ocher yellow on the head and thorax and light reddish brown or orange on the abdomen. The lateral and ventral carinas on the fourth segment are separated a distance about $\frac{1}{3}$ of the length of the lateral carina. The external branch of the male hamule and the genital lobes reach about equally far ventrad, or the genital lobes are slightly longer. The apical ventral teeth on the superior appendage reach about as far as the distal end of the inferior appendage. In anteroventral view, the lamina of the female is semi-circular and about 0.65 mm in length from the base of the basal lobe to the apex. The apex of the ninth sternite has a single row of bristles (**Fig. 3.2.164**).

.....*Erythemis peruviana* (Rambur 1842)
 (North and Central America, West Indies, Colombia, Venezuela, French Guiana, Guyana, Surinam, Ecuador, Peru, Bolivia, Paraguay, Argentina, Pará, Mato Grosso, Mato Grosso do Sul, Rio de Janeiro, São Paulo). Syn: *Libellula peruviana* Rambur, 1842; *Libellula bicolor* Erichson, 1848; probably *Libellula rubriventris* Blanchard, 1845.

- The dark basal cloud on the hind wing reaches beyond the cubito-anal cross vein. The thorax is not patterned with a dorsomedian rectangular pale area bordered by black on either side. The lateral and ventral carinas on the fourth

segment are separated a distance less than $\frac{1}{3}$ the length of the lateral carina. The external branch of the male hamule obviously reaches ventrad beyond the genital lobes. The apical processes of the penis curve ventrad (**Fig. 3.2.168**). In anteroventral view, the lamina of the female is not semi-circular; it is about 1.2 mm in length from the base of the basal lobe to the apex. The apex of the ninth sternite has a patch of bristles.9



Fig. 3.2.169 Penis of *Erythemis mithroides* in lateral view (left) and a similar view with the lateral lobe removed to show the internal structures. Based on Kennedy (1923).

9. The thorax is mainly dark and either intricately patterned with pale markings or completely black in old males. The head and thorax are densely covered by hair-like setae, which are black in males and brownish yellow in females. The abdomen is mainly dark with large, conspicuous yellow basal or subbasal patches only narrowly separated by black along the midline on the fourth and seventh tergites, or it is all black in old males. The lateral and ventral carinas on the fourth segment are separated a distance less than $\frac{1}{4}$ the length of the lateral carina. The lateral lobe of the penis narrows slightly proximal to its truncate end (**Fig. 3.2.168**). The apex of the inferior appendage of the male extends beyond the ventral teeth on the superior appendage. In anteroventral view, the lamina of the female is nearly as long as wide and has a rounded triangular shape with a base that is slightly swollen on either side. The female is brownish yellow with reddish markings at the junctions of the abdominal segments. The dark basal cloud on the wings is black in the male and reddish brown in the female.

.....*Erythemis attala* (Selys in Sagra, 1857)
(Central America, West Indies, Colombia, Venezuela, Guyana, French Guiana, Surinam, Ecuador, Peru, Bolivia, Paraguay, Argentina, Uruguay, Pará, Mato Grosso, Mato Grosso do Sul, Rio de Janeiro, São Paulo). Syn: *Libellula attala* Selys, 1857; *Libellula annulata* (nec Beauvois, 1805) Rambur, 1842; *Libellula annulosa* Selys in Sagra, 1857; *Libellula mithra* Selys in Sagra, 1857.

- The thorax is pale yellowish, greenish, or dark red without dark markings. The abdomen is mainly pale with either yellowish or bright red yellow basal or subbasal patches narrowly separated by black along the midline on the fourth and seventh tergites, or it is all black in old males. The lateral and ventral carinas on the fourth segment are separated a distance between $\frac{1}{3}$ and $\frac{1}{4}$ the length of the lateral carina. The lateral lobe of the penis is widest at its truncate end (**Fig. 3.2.169**). The apex of the inferior appendage of the male extends about an equal length posteriad as the ventral teeth on the superior appendage. In anteroventral

view, the lamina of the female has three lobes; its width is about 1.5 times its length. The wings are mainly hyaline with a basal cloud on the hind wing, varying from yellowish or amber to dark reddish brown. The pterostigma is blackish.

.....*Erythemis mithroides* (Brauer, 1900)
(Central America, Trinidad, Colombia, Peru, Venezuela, Guyana, French Guiana, Surinam, Bolivia, Paraguay, Argentina, Rio de Janeiro). Syn: *Mesothemis mithroides* Brauer, 1900.

Key to the species of adult *Orthemis* in South America

Information for the key obtained from Karsch (1891), Calvert (1899), and Buchholtz (1950).

1. The abdomen is predominantly pitch brown or black, sometimes with lighter colors on the basal segments or longitudinal red lateral or mid-dorsal markings, which may become extensive on females (Fig. 3.2.170).2
- The abdomen of mature specimens is predominantly red, light reddish brown, or ferrugineous, but there may be some narrow dark brown or black markings or dark basal or apical segments (Fig. 3.2.171). Some specimens of some species are grayish blue, possibly a sign of senescence. For such specimens, size and the illustrations of morphological structures, if available, will have to be relied upon for identification.7

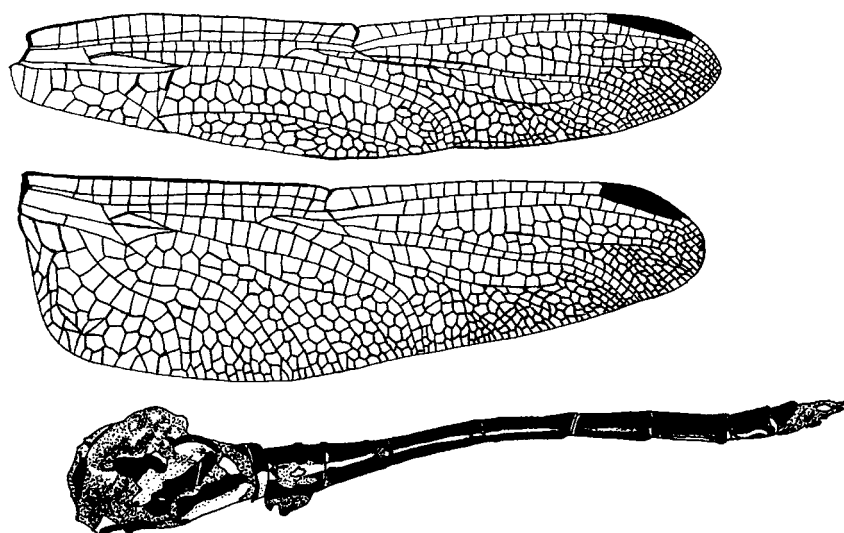


Fig. 3.2.170 *Orthemis flavopicta*: fore and hind wing (above) and a lateral view of the thorax and abdomen of a male (below).

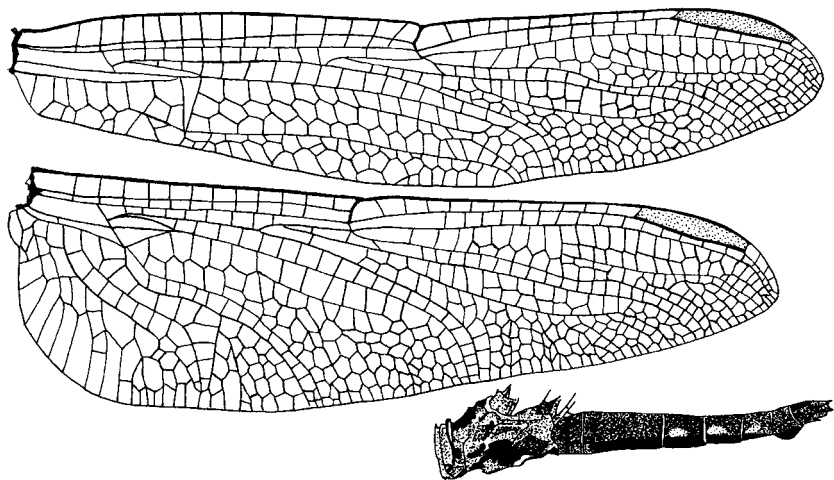


Fig. 3.2.171 *Orthemis nodiplaga*: fore and hind wing (above) and a lateral view of the thorax and abdomen of a male (below right).

2. There are no traces of lateral red markings on the fourth through tenth abdominal segments of either sex (**Fig. 3.2.170**).3
- There are at least faint reddish brown lateral markings on the middle abdominal segments of the males, and these may come to occupy half of the surface of the segments of the female (**Fig. 3.2.172**).5

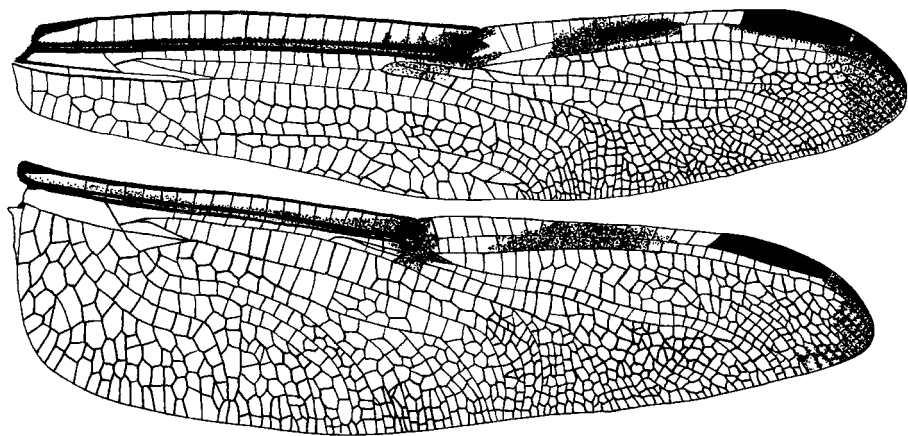


Fig. 3.2.172 Fore and hind wing of *Orthemis regalis*.

3. The head, thorax, abdomen, and all of the legs of the male are predominantly black or blackish brown with yellow stripes on the thorax and narrow yellow lateral and mid-dorsal lines along some of the abdominal segments. The fourth through seventh abdominal tergites of the female are predominantly black with yellow longitudinal lines on the mid-dorsal carina and along both lateral margins (**Fig. 3.2.170**). The wings are smoky amber with blackish veins and dark brown pterostigmas.

.....*Orthemis flavopicta* Kirby, 1889
(Central America, Peru, French Guiana, Argentina, Brazil).

- The abdomen is predominantly black, but the head and thorax are considerably lighter in color.4

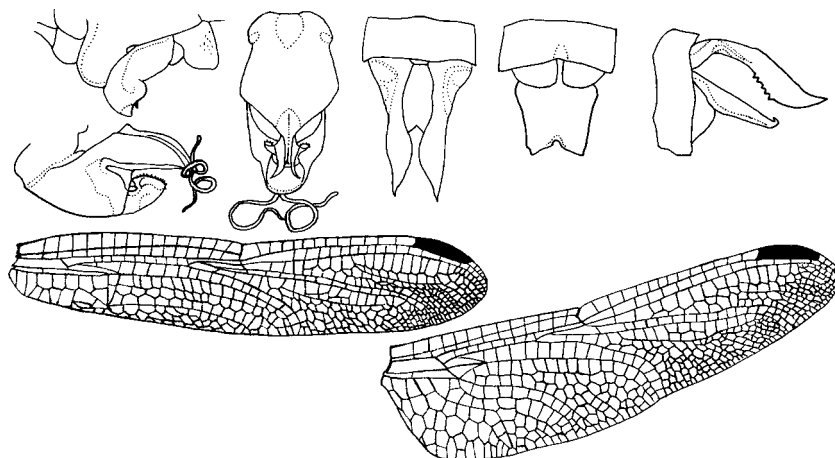


Fig. 3.2.173 *Orthemis anthracina* male: male genitalia on the second abdominal segment in lateral view (upper left), apex of penis in lateral (middle left) and ventral view (upper left center), apex of the male abdomen in dorsal view (upper center), ventral view of the inferior anal appendage (upper right center), apex of the male abdomen in lateral view (upper right), and the fore (lower left) and hind wing of a male (lower right). Based in part on DeMarmels (1989a).

4. The male has two metallic blue or turquoise spots on the frons, easily seen in dorsal view. The three anterior segments of the male abdomen may have dirty yellow lateral markings. The fourth through tenth abdominal segments of the male are entirely black except for tiny dark yellow lateral ridges on some of the segments. The head and thorax of the male are mainly reddish brown with dark yellow lateral stripes on the thorax. The middle and hind legs are black, except at the brown bases of the femora. The fore-leg is black at the apices of the femora and tibiae and on the tarsi. The wings are smoky amber with dark brown veins and a chestnut brown pterostigma. In ventral view, a row of about five coarse ventral teeth are evident on the distal half of the superior anal appendage

(**Fig. 3.2.173**). Length of male abdomen with appendages: c. 23 to 24 mm. Hind wing length of male: c. 27 to 28 mm.

.....*Orthemis anthracina* DeMarmels, 1989
(Peru, Venezuela).

- The frons of the male is uniformly dark reddish brown, sometimes with a slight violet sheen. The three anterior segments of the male abdomen may be largely yellowish green. The fourth through tenth abdominal segments of the male and female are usually entirely black. The ventral surface of the seventh abdominal segment of the female is mainly olive greenish. The thorax of both sexes is mainly bright reddish brown with prominent yellow lateral stripes, including two broad ones and sometimes a smaller yellow marking between them. The legs are black with a vague brownish area at the bases of the femora and a brownish area on the fore-tibia. The wings are usually hyaline with slight brownish clouding at the apices, blackish veins, and brownish black pterostigmas (**Fig. 3.2.174**). Length of male abdomen with appendages: c. 31 to 32 mm. Hind wing length of both sexes: c. 34 to 35 mm.

.....*Orthemis attenuata* (Erichson, 1848)
(Jamaica, Venezuela, Guyana, French Guiana, Surinam, Peru). Syn: *Libellula attenuata* Erichson, 1848.

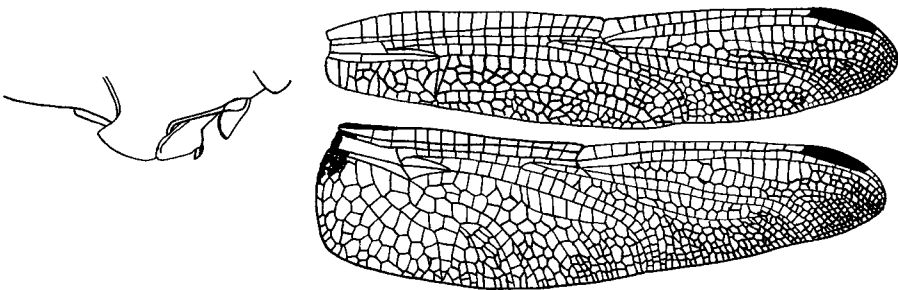


Fig. 3.2.174 The male genitalia on the second abdominal segment of *Orthemis attenuata* in lateral view (left) and the fore and hind wing (right). Based in part on Rácenis (1953b).

5. The wings usually have conspicuous dark markings parallel to the anterior margin of the wing and at the apex; these do not cover the costal space and are interrupted in places between the nodus and pterostigma (**Fig. 3.2.172**). The

abdomen of the female is pitch brown with dark reddish lateral and mid-dorsal markings. The head and thorax are yellow and brown with metallic violet reflections in places.

.....*Orthemis regalis* Ris, 1910
(Ecuador, Peru, Venezuela, French Guiana, Brazil).

- There are no conspicuous dark markings on the wings, which are either hyaline or somewhat smoky (**Fig. 3.2.76**).6



Fig. 3.2.175 *Orthemis cultriformis* male (upper row, left to right): lateral outline of the genitalia on the second abdominal segment, hamule, superior anal appendages in dorsal view, and (lower row, left to right): penis in lateral view, inferior anal appendage in ventral view, anal appendages in lateral view. Based on Santos (1967d).

6. Either the thorax is uniformly colored, or it has extensive pale areas forming more than two lateral stripes. The color of the abdomen is dark brown with lighter reddish brown markings, which sometimes occupy large areas of the segments. The first four segments of the abdomen are usually paler than those apical to it (**Fig. 3.2.76**).

.....*Orthemis concolor* Ris, 1919
(Trinidad, Venezuela, Ecuador, Peru, Guyana, French Guiana, Surinam, Brazil).

- The thorax is dark with two contrasting yellowish lateral stripes. There are no denticles on the anterior surface of the anterior lamina on the second abdominal segment of the male. The hamule obviously extends below the level of the anterior lamina (**Fig. 3.2.175**). Total length: 46 to 47 mm. Length of abdomen: 31 to 32 mm; of fore-wing: 37 to 39 mm; of hind wing: 36 to 38 mm; of pterostigma: 5 mm. Male chromosome number: $2n = 23$, $n = 12$ (Ferreira *et al.*, 1979).

.....*Orthemis cultriformis* Calvert, 1899
(Central America, Trinidad, Colombia, Venezuela, Guyana, French Guiana, Surinam, Ecuador, Peru, Bolivia, Paraguay, Argentina, Amazonas, Espirito Santo, São Paulo, Rio de Janeiro, Mato Grosso).

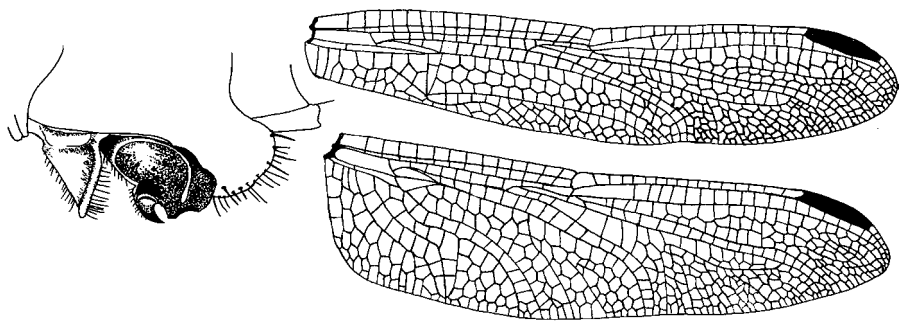


Fig. 3.2.176 *Orthemis plaumanni*: fore and hind wing (right) and male genitalia on the second abdominal segment (left). Based in part on Buchholtz (1950).

7. Length of pterostigma: 5.5 to 7 mm (**Fig. 3.2.171**).8
- Length of pterostigma: 5 mm or less (**Fig. 3.2.176**).12
8. The nodus on all wings is bordered by reddish brown (**Fig. 3.2.171**). Male and female specimens are usually almost uniform brownish red or yellowish brown with reddish brown clouds along the anterior fields of the wings. Total length of the female: c. 45 mm. Length of female abdomen: 28.5 mm. Hind wing length of female: c. 38 mm. Length of pterostigma: c. 6.5 mm.
.....*Orthemis nodiplaga* Karsch, 1891
(Argentina, Uruguay, Bolivia, Rio Grande do Sul)
- The nodus is not bordered by brown (**Fig. 3.2.177**).9
9. The pterostigma of the female may be as short as 5.5 mm (**Fig. 3.2.177**).10
- The pterostigma of the male and the female is at least 6 mm long. The synthorax of the male is mainly bright violet or dark purple; that of the female is

uniform ferruginous or brown with yellow stripes and black wing veins (**Fig. 3.2.178**).11

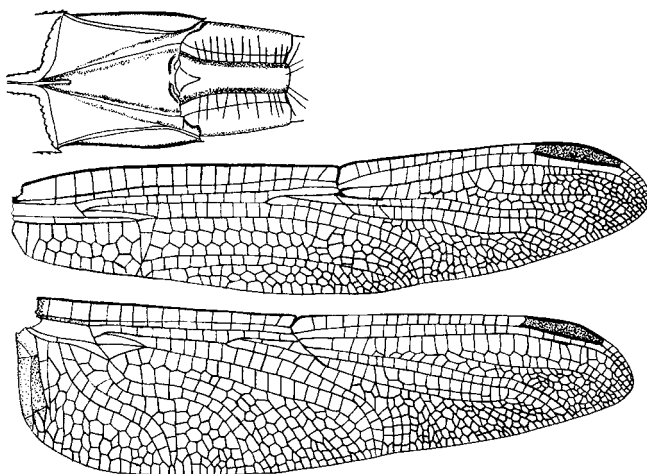


Fig. 3.2.177 *Orthemis schmidtii*: fore and hind wing of a male (below) and eighth and ninth abdominal segment of a female in ventral view (above). Based in part on Buchholtz (1950).

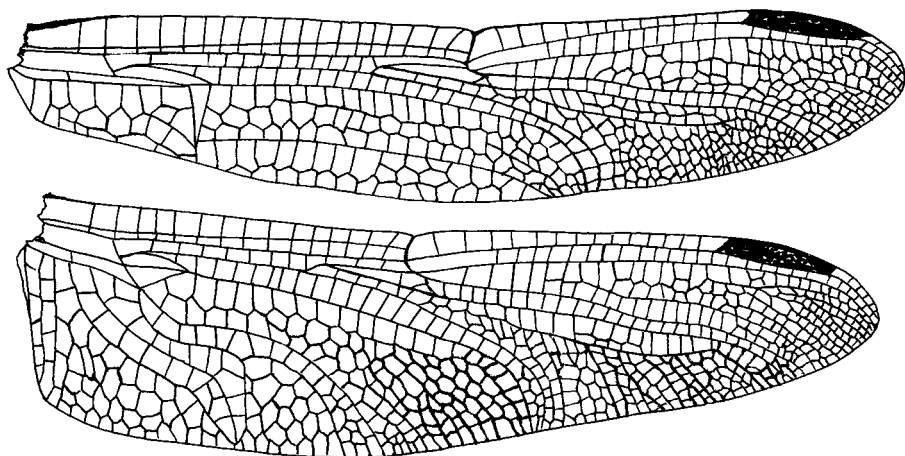


Fig. 3.2.178 Fore and hind wing of *Orthemis discolor*.

10. The synthorax of the mature male is reddish with golden yellow areas; that of the female is yellowish brown or sometimes purplish with better-defined yellow stripes. The wing veins are reddish brown, or some are bordered by

reddish brown membrane (**Fig. 3.2.179**). The labium of the female is yellow with a dark brown median stripe. The superior and inferior anal appendages appear slender and almost equal in length in lateral view. Length of female abdomen: 28 to 33 mm long. Hind wing length of female: 38 to 43 mm.

.....*Orthemis aequilibris* Calvert, 1909
(Panama, Colombia, Peru, Venezuela, Guyana, French Guiana, Surinam, Bolivia, Paraguay, Bahía, Espirito Santo, Minas Gerais).

- The synthorax of the male is mainly bright violet or dark purple on a reddish brown ground color. There is a pair of dull violet spots on the frons of the male. The wing membranes are clouded amber, and the veins are black. The pterostigma is brownish black, and the apices of the wings may be darkened (**Fig. 3.2.177**). In lateral view, the superior anal appendage of the male appears stout, and the inferior appendage, small. Length of male abdomen: c. 32.5 mm. Hind wing length of male: c. 41 mm. The abdomen is dull yellowish red with dark and light areas but nowhere blackish. The female has not been described.

.....*Orthemis schmidtii* Buchholz, 1950
(Trinidad, Ecuador, Peru, Venezuela, French Guiana, Surinam, Bolivia, Brazil).

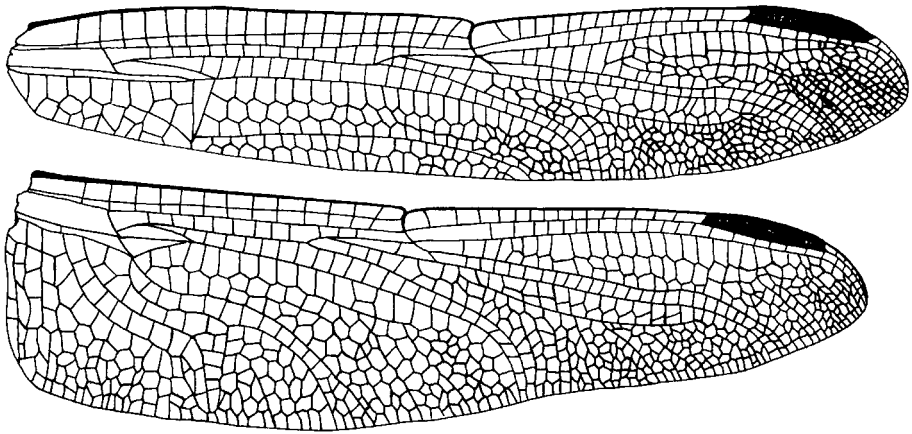


Fig. 3.2.179 Fore and hind wing of *Orthemis aequilibris*.

11. The wing membrane is hyaline to a point beyond the level of the apical margin of the reddish brown pterostigma, but it has a reddish or yellowish tinge at the extreme apices of the wings (**Fig. 3.2.178**). The labium usually lacks a distinct black median band. Male and female specimens are almost entirely dark red, but the tarsi and posterior margins of most abdominal segments are blackened, and some males have a bright violet tinge on the synthorax. The

anterior veins of the wings are bright reddish, and there is a yellowish stain on the membranes at the apices of the wings.

.....*Orthemis discolor* (Burmeister, 1839)
(Central America, Colombia, Venezuela, French Guiana, Guyana, Surinam, Ecuador, Peru; Bolivia, Paraguay, Chile, Argentina, Uruguay, Rio de Janeiro, São Paulo, Minas Gerais, Mato Grosso, Mato Grosso do Sul). Syn: *Libellula discolor* Burmeister, 1839; *Libellula macrostigma* Rambur, 1842. This species is sometimes regarded as being conspecific with the North and Central American *Orthemis ferruginea* (Fabricius, 1775), but work with living specimens strongly indicates that they are distinct (D. R. Paulson, pers. comm.).

- A chestnut brown clouding on wing tips reaches the level of the dark purplish brown pterostigma. The wings are otherwise hyaline with dark brown or blackish veins. There are about 22 antenodal cross veins in the fore-wing (**Fig. 3.2.180**). The labium has a broad black median band. Males and females are predominantly deep purplish red with yellowish lateral stripes on the synthorax of the female and blackish tibiae and tarsi.

.....*Orthemis sulphurata* Hagen, 1868
(Trinidad, Venezuela?, Ecuador, Peru?).

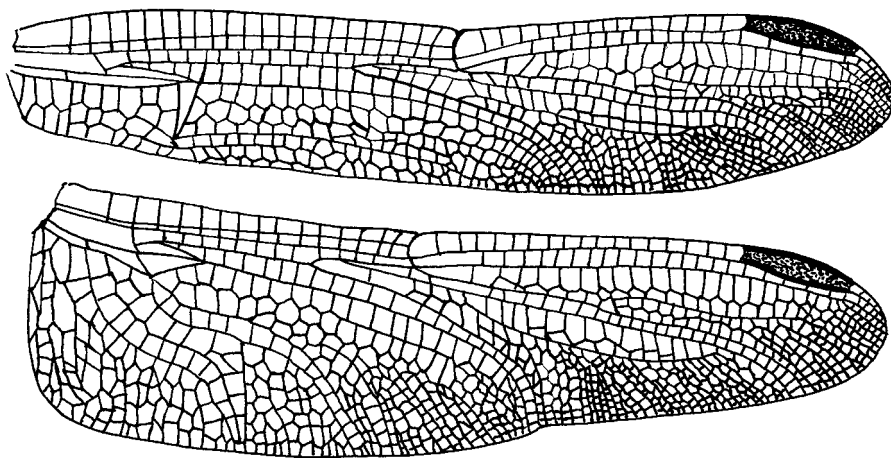


Fig. 3.2.180 Fore and hind wing of *Orthemis sulphurata*.

12. The three apical segments of the abdomen of the male have no distinct black markings at all, although the segments and the anal appendages may be vaguely darkened. The dorsal surface of the tenth abdominal segment is never entirely black.13

- The abdomen is mainly bright scarlet with black margins of the segments and extensive, well defined black markings on the dorsal surface of the three apical segments (**Fig. 3.2.177**).14

13. The lateral surface of the thorax has five long, rather narrow yellowish stripes, two of which are wide, and the others very thin. The fourth segment of the male abdomen is about 2.8 times its width at the apex and 3.4 times its width at its base. Length of male abdomen: c. 34 mm. Hind wing length of male: c. 38 mm.

.....*Orthemis ambirufa* Calvert, 1909
(Venezuela, French Guiana, Surinam, Argentina, Mato Grosso). Syn: *Orthemis sibylla* Ris, 1919.

- The thorax of the male and the female is reddish brown with five long, rather narrow yellowish stripes on the lateral surface, as well as a few small yellow markings. The male has a pair of bright violet spots on the frons. The male abdomen is bright red with darkened apical segments and partially black anal appendages. The proximal abdominal segments of the female are dark brown with small yellow lateral markings; the apical segments are bright red (**Fig. 3.2.181**). Length of male abdomen: c. 30 to 31 mm; female abdomen: c. 27 mm. Hind wing length of both sexes: 35 to 37 mm.

.....*Orthemis biolleyi* Calvert, 1906
(Central America, Trinidad, Colombia, Venezuela, French Guiana, Guyana, Surinam, Ecuador, Peru, Bolivia, Mato Grosso).

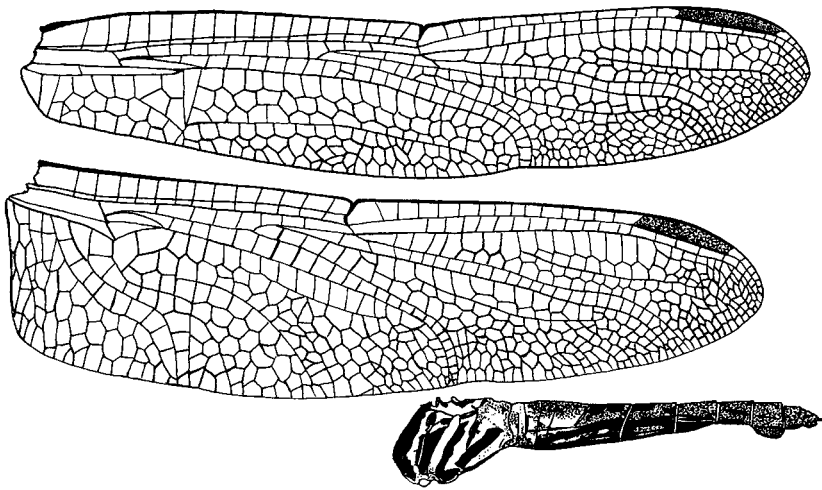


Fig. 3.2.181 *Orthemis biolleyi* female: fore and hind wing (above), thorax and abdomen in lateral view (below).

14. The nodus is located about 0.5 mm proximal to the midlength of the forewing. Bridge cross veins are present. The head and thorax of the male are mainly brown with blackish markings. The first and proximal part of the second abdominal segment of the male are yellowish red, and the rest of the abdomen is vivid red with black seams and a broad black middorsal stripe on the eighth and

ninth segments. There are black flecks on the third through tenth segments. The hamule extends below the broad genital lobe on the male genitalia (**Fig. 3.2.177**). Length of male abdomen: c. 34 mm. Hind wing length of male: c. 36 mm. Length of pterostigma: c. 5 mm. The female has not been described. That this species is distinct from both in the next couplet seems unlikely.

.....*Orthemis plaumanni* Buchholtz, 1950
(Peru, São Paulo, Santa Catarina).

- The nodus is located at or distal to the midlength of the fore-wing (**Fig. 3.2.182**).15

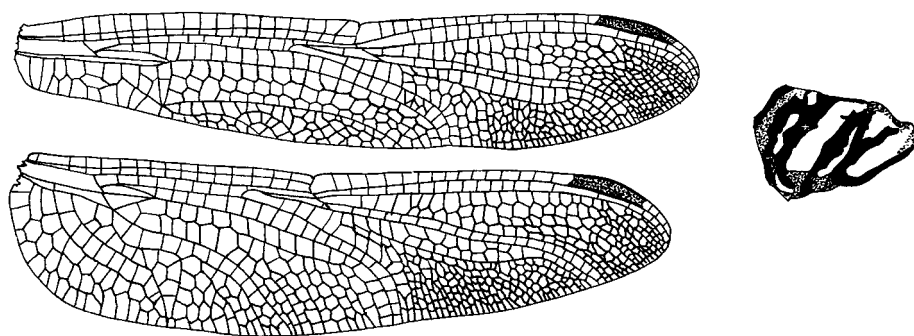


Fig. 3.2.182 *Orthemis levis*: Fore and hind wing (left) and the color pattern on the lateral surface of the thorax of a female (right).

15. There are broad black bands and various small markings at the junctions of the red abdominal segments of the male. The tenth segment and appendages are uniformly black, and there is a black dorsal band covering about 1/3 of the width of the eighth abdominal segment and somewhat more of the width of the ninth. The head is brilliant violet on the vertex. The thorax is chestnut brown with ferruginous stripes. There are tiny denticles on the anterior surface of the anterior lamina on the second abdominal segment of the male. This lamina, hamule, and genital lobe reach about the same distance ventrad (**Fig. 3.2.183**). Length of male abdomen: 29 to 32 mm. Hind wing length of male: 35 to 38 mm. The pterostigma is approximately 4 mm long. The female has not been described.

.....*Orthemis ambinigra* Calvert, 1909
(Argentina, Pernambuco, Bahia, Espirito Santo, Minas Gerais, Rio de Janeiro, Santa Catarina, Rio Grande do Sul).

- The abdomen of the male is almost uniformly red with black only on very narrow rings between some segments, small dorsal markings on the eighth and ninth segments, and the entire tenth segment with appendages. There is a small

violet marking on the vertex of the male. The entire male thorax and a broad band around the middle of the femora are dark reddish brown. The legs are otherwise mainly black. The female has similar coloration except for its prominent yellow markings on the lateral surfaces of the thorax and first two or three abdominal segments and its lack of violet markings on the vertex (**Fig. 3.2.182**). Length of abdomen: 33 to 35 mm. Hind wing length: 37 to 39 mm. The pterostigma is about 4.5 to 5.0 mm long.

.....*Orthemis levis* Calvert, 1906
(Mexico, Central America, Venezuela).

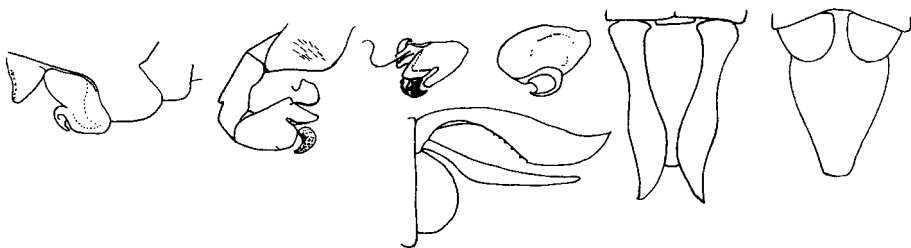


Fig. 3.2.183 *Orthemis ambinigra* male (left to right): genitalia on the second abdominal segment in lateral view, penis in lateral and in oblique ventral view (above), hamule in frontal view (above), and the apex of the abdomen in lateral (below), dorsal, and ventral view. Based on Santos (1967e).

Key to the species of known *Orthemis* larvae in South America

Information for the key was provided by DeMarmels (1990a), Rodrigues Capítulo and Muzón (1990a), Fleck (2003a).

1. The anterior margin of the prementum forms an angle at the midline that is slightly more than 90°. The setae on the prementum are inserted along a curved line with the six longest parallel to the lateral margin, and the five smallest set nearly perpendicular to the margin. The entire body is covered with long, hair-like setae (**Fig. 3.2.184**).

.....*Orthemis levis* Calvert, 1906
(Mexico, Central America, Venezuela).

- The anterior margin of the prementum is much closer to forming a straight line than a right angle; a small, rounded protrusion along the midline extends beyond the crenulations along the margin. The premental setae are inserted along a sigmoid line, with three or four clearly longer than the rest (**Fig. 3.2.185**).

..... 2

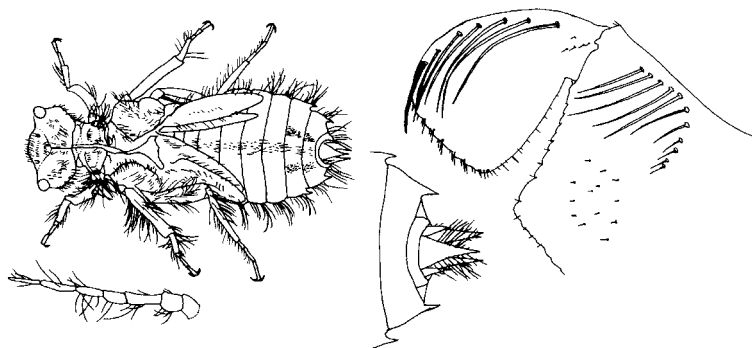


Fig. 3.2.184 *Orthemis levis* larva: habitus from an exuvia (upper left), antenna (lower left), labial palp and anterior part of the labium (right), and the apex of the abdomen in dorsal view (lower center). Based on DeMarmels (1990a).

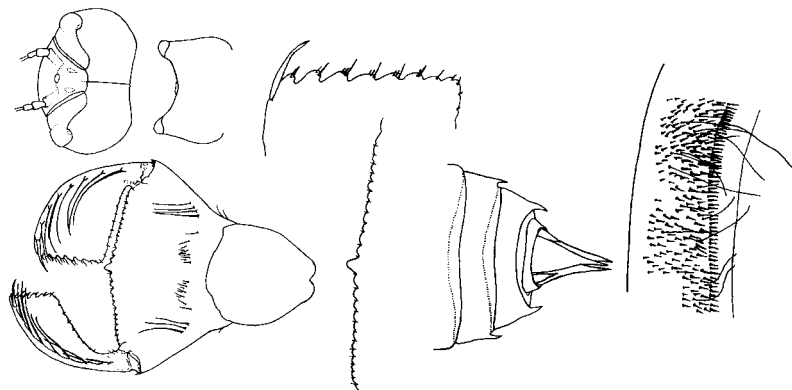


Fig. 3.2.185 *Orthemis biolleyi* larva: head without the apical segments of the antennae in dorsal (upper left) and posterior view, showing the shape of the compound eyes (upper left center), labium in dorsal view (lower left), inner margin of a labial palp (upper center), anterior margin of the prementum (lower left center), apex of the abdomen in dorsal view (lower right center), and details of the dorsal surface on the right side of the eighth abdominal segment (right). Based on Fleck (2003a).

2. About ten long setae are present on the labial palp proximal to the moveable tooth. The line of three longer premental setae form a continuous line with the nine or ten shorter ones (**Fig. 3.2.115**).

.....*Orthemis aequilibris* Calvert, 1909
(Panama, Colombia, Peru, Venezuela, Guyana, French Guiana, Surinam, Bolivia, Paraguay, Bahía, Espirito Santo, Minas Gerais).

- About seven or eight long setae are present on the labial palp proximal to the moveable tooth (**Fig. 3.2.185**).3

3. About seven long setae are present on the labial palp proximal to the moveable tooth. The line of three or four longer premental setae are well separated from the line of nine or ten shorter ones. The eighth abdominal segment has dense areas of short, triangular setae on the dorsum (**Fig. 3.2.185**).

.....*Orthemis biolleyi* Calvert, 1906
(Central America, Trinidad, Colombia, Venezuela, French Guiana, Guyana, Surinam, Ecuador, Peru, Bolivia, Mato Grosso).

- About eight long setae are present on the labial palp proximal to the moveable tooth. A line of four longer premental setae, one of median length, and about seven short ones is present on each side of the prementum (**Fig. 3.2.9**).

.....*Orthemis nodiplaga* Karsch, 1891
(Argentina, Uruguay, Bolivia, Rio Grande do Sul)

Key to the species of adult male *Libellula* in South America

Information for the key was provided by DeMarmels (1982a). A key to the larvae could not be prepared.

1. The abdomen is bright red; the head and thorax are reddish brown with a narrow yellow middorsal stripe. The wings are often clouded with amber at the bases, and the veins in the anterior portions of the wings are red (**Fig. 3.2.78**).

.....*Libellula croceipennis* (Selys, 1868)
(North and Central America, Colombia). Syn: *Libellula saturata aliasignata* Muttkowski, 1910; *Belonia uniformis* Kirby, 1889.

- The entire male is dark blood-red. The wings are hyaline with black veins.

.....*Libellula herculea* Karsch, 1889
(Central America, Colombia, Ecuador, Peru, Venezuela, Guyana, French Guiana, Bolivia, Paraguay, Argentina, São Paulo, Mato Grosso do Sul). Syn: *Belonia longipennis* Kirby, 1889. This species is considered endangered in Brazil.

Key to the species of adult *Nephepeltia* in South America

Information for the key was provided by Calvert (1909b) and Rácenis (1953a). A key to the larvae cannot yet be prepared.

1. The face is dark with patches of brown or red ventral to shiny bluish patches in the ocular area. The entire basal, ventral edge of the male superior anal appendage is lined with coarse teeth as far as its prominent angle (**Fig. 3.2.77**).

.....*Nephepeltia leonardina* Rácenis, 1953
(Peru, Ecuador, Venezuela).

- The face is yellow below the shiny bluish patches in the ocular area, or coarse teeth are also present distal to the angle of the superior anal appendage or absent from its basal part (**Fig. 3.2.186**).2

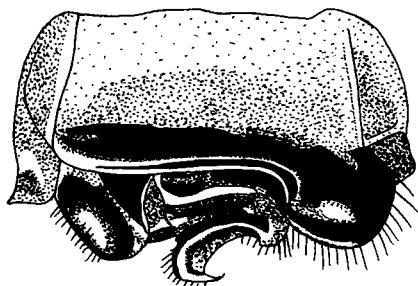


Fig. 3.2.186 Male genitalia on the second abdominal segment of *Nephepeltia flavifrons* in lateral view. Based on Ris (1911a).

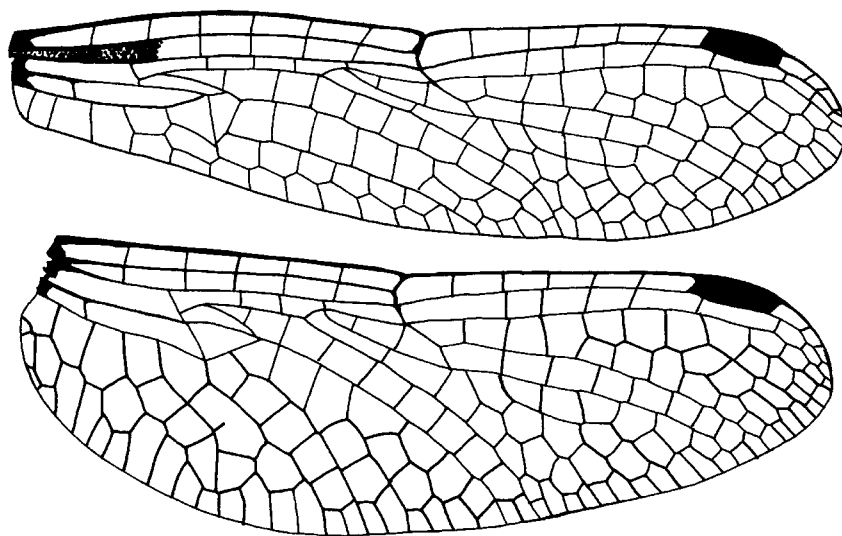


Fig. 3.2.187 Fore and hind wing of *Nephepeltia phryne*. Based on Ris (1911a).

2. The inferior anal appendage is almost as long as the superior appendage. The superior anal appendage of the male has a tooth on the ventral surface inserted about $\frac{3}{4}$ of the way from the base to the apex; distal to the tooth, the appendage extends nearly straight posteriad and tapers to an acute tip. There is no conical spine on the metasternum. Length of abdomen: 12 to 13.5 mm. Hind wing length: 15 to 17 mm.

.....*Nephepeltia aequisetis* Calvert, 1909
(Bolivia, Paraguay, Mato Grosso, Mato Grosso do Sul, São Paulo).

- The inferior anal appendage is about three quarters as long as the superior appendage.3

3. Coarse teeth are present on the ventral surface of the superior anal appendage of the male on both sides of the prominent angle.

.....*Nephepeltia berlai* Santos, 1950
(São Paulo).

- Coarse teeth or fine denticles are absent from the ventral surface of the superior anal appendage of the male distal to the prominent angle, and they are also absent from much of the basal part of the appendage.4

4. There is a large conical spine on the metasternum. The superior anal appendage of the male is slender and exceeds the combined lengths of the ninth and tenth abdominal segments; its large ventral tooth is located about 2/3 of the way from the base to the apex, after which the appendage curves dorsad. The subcostal space on the fore-wing is usually darkened as far as or beyond the second antenodal cross vein (**Fig. 3.2.187**). The thorax and abdomen of the male are black with purplish to yellow areas around the wing roots and on the ventral side of the thorax and laterally on the anterior seven segments of the abdomen. The female is black with strongly contrasting yellow markings, including a stripe on the fore-femur, a splash of yellow on the lateral surface of the synthorax, and dorsolateral markings on the fourth through eighth abdominal segments.

.....*Nephepeltia phryne* (Perty, 1834)
(Central America, Trinidad, Ecuador, Peru, Venezuela, Guyana, French Guiana, Surinam, Argentina, Rio de Janeiro, São Paulo, Mato Grosso do Sul). Syn: *Libellula phryne* Perty, 1834; *Dythemis apicalis* Hagen, 1861 (*nodum nudum*); *Nannophya semiaurea* Hagen, 1861 (*nodum nudum*). Two subspecies have been described: *Nephepeltia phryne phryne* (Perty, 1834); and *Nephepeltia phryne tupiensis* Santos, 1950.

- There is no conical spine on the metasternum. The superior anal appendage of the male has a tooth on the ventral surface inserted at or proximal to its midlength; distal to the tooth, the appendage curves dorsad and remains parallel-sided until it ends in a short spine. The hamule extends below the genital lobe (**Fig. 3.2.186**). The inferior anal appendage is only about 3/4 of the length of the superior appendage. The thorax of the male is metallic black with bluish green reflections and dull yellow and purplish brown markings. The abdomen of the male is black with yellow lateral markings, usually on the third through seventh segments, the largest of which are on the third and seventh segments. The coloration of the female is either similar to that of the male or it is a somewhat similar pattern in yellowish brown and yellow. The bases of the wings of the female are obviously clouded in golden yellow.

.....*Nephepeltia flavifrons* (Karsch, 1889)
(Colombia, Peru, Venezuela, French Guiana, Surinam, Paraguay, Argentina, Rio de Janeiro, São Paulo, Rio Grande do Sul, Mato Grosso). Syn: *Neothemis flavifrons* Karsch, 1889; *Nannothemis inermis* Hagen, 1867 (*nodum nudum*); *Nannothemis prodita* Hagen, 1861 (*nodum nudum*).

Key to the species of adult *Micrathyria* in South America

This key will be reliable only for male specimens, but it includes available information on the females. Information for the key was provided by Kirby (1897), Calvert (1909b), Ris (1911a, 1919), Navás (1922a), Santos (1945b, c; 1946a, b, c; 1947a; 1949b; 1953b; 1965a), Geijskes (1963), Westfall (1992), Tennessen (2000), and Costa *et al.* (2002). The genus is in need of revision.

1. Only the female has been described. The face is ferruginous, and the compound eyes are black. The thorax is blackish with yellow dorsal stripes and a yellow lateral mark divided in two by a black stripe. The legs are black. There are rows of five spines on the middle section of the fore-femur and ten spines on the hind femur, increasing in length toward its apex. The abdomen is black with a yellow dorsal stripe beginning on the first segment. The dark reddish brown pterostigma on the fore-wing is 2.5 mm long. There are 10½ antenodal cross veins in the fore-wing and 7½ in the hind wing. There is a light yellow stripe along the costal and subcostal spaces in the fore-wing, and the wings become dark brownish toward the apex (**Fig. 3.2.188**). The subtriangle in the hind wing is divided into two cells. Hind wing length: c. 26 mm. From the original description, this species cannot be identified with certainty.

.....*Micrathyria duplicata* Navás, 1922 (Peru).

- There is a different combination of characters.2

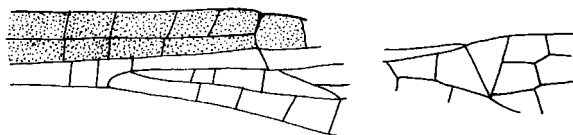


Fig. 3.2.188 *Micrathyria duplicata*: anterior border of the fore-wing proximal to the nodus (left) area of the triangle in the hind wing. Based on Navás (1922a).

2. In the hind wing, only one cell separates the posterior angle of the triangle and vein A_2 , as designated by Needham (1903) and also called vein $Aspl$, the bisector of the anal loop (**Fig. 3.2.189**).3

- In the hind wing, there are two cells between the posterior angle of the triangle and vein A_2 (**Fig. 3.2.190**).27

3. The triangle and subtriangle of the fore-wing are free, that is, not crossed by veins (**Fig. 3.2.191**).4

- The subtriangle of the fore-wing is usually crossed, and sometimes, the triangle is, as well (**Fig. 3.2.192**). Unfortunately, this feature is variable, but only a small percentage of the subtriangles of species in this group are not crossed. Therefore, if the subtriangle in one fore-wing is not crossed, check the other, and if it is crossed or if spurs of veins indicate partial crossing of the subtriangle in either wing, the specimen belongs in this group.15

4. There is only one row of cells in the discoidal space of the fore-wing (**Fig. 3.2.189**). The thorax has contrasting light and dark markings.5
 - More than one row of cells is in the discoidal space of the fore-wing (**Fig. 3.2.192**).7

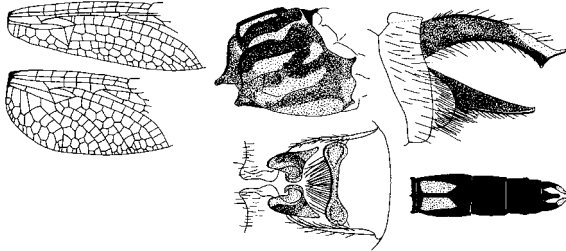


Fig. 3.2.189 *Micrathyria caerulistyla* male: proximal parts of the fore and hind wing (left), synthorax in lateral view (upper center), male genitalia on the second abdominal segment (lower center), apex of the male abdomen in lateral view (upper right), and apical segments of the abdomen in dorsal view, with the stippled areas bright blue. Based on Donnelly (1992).

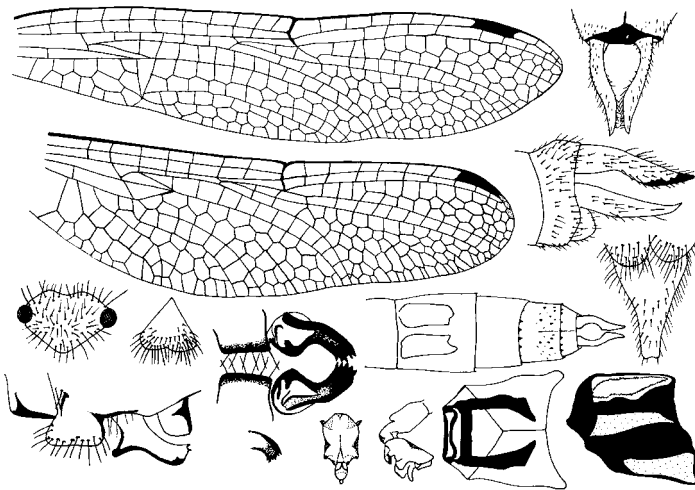


Fig. 3.2.190 *Micrathyria pseudhypodidyma* male: fore and hind wing (upper left), superior anal appendages (upper right), apex of the abdomen in lateral view (upper middle right), and (middle row, left to right): vertex, occiput, hamules in ventral view, apical segments of the abdomen in dorsal view, and inferior anal appendage in ventral view; and (lower row, left to right): genitalia on the second abdominal segment in lateral view, apex of a hamule in frontal view, penis in ventral and lateral view, and the color pattern on the synthorax in dorsal and lateral view. Based on Costa *et al.* (2002).

5. There are $9\frac{1}{2}$ antenodal cross veins in the fore-wing. The arculus is located about midway between the first and second antenodal cross veins. The apical half of the superior anal appendage of the male is blue. The face and labium are greenish white, and the dorsal part of the frons and vertex are blue. The occiput is black with a pair of yellow spots. The thorax is dark brown with light brown and greenish markings, and the abdomen is black with blue markings (**Fig. 3.2.189**). The bases of the femora are dark. Length of male abdomen: 17 to 19 mm. Hind wing length of male: 21 to 22.5 mm. The female has not been described.

.....*Micrathyria caerulistyla* Donnelly, 1992
(Central America, Ecuador).

- There are no more than $7\frac{1}{2}$ antenodal cross veins in the fore-wing (**Fig. 3.2.191**).6

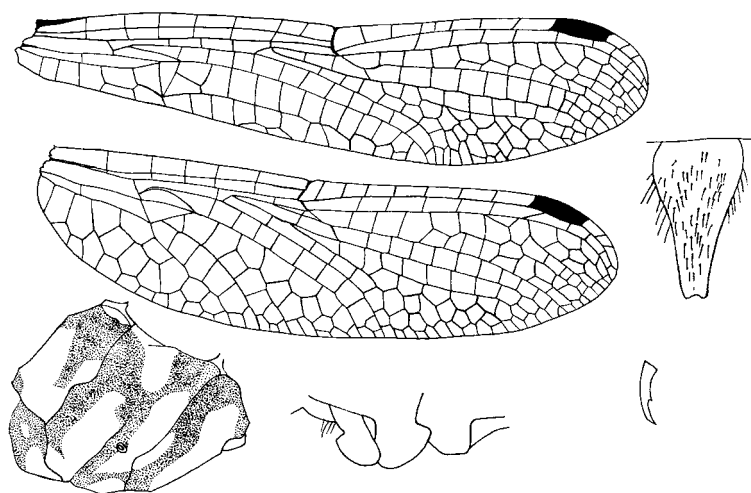


Fig. 3.2.191 *Micrathyria romani* male: fore and hind wing (upper left), color pattern on the synthorax (lower left), genitalia on the second abdominal segment in lateral view (lower center), tarsal claw (lower right), and the inferior anal appendage in ventral view (upper right). Based on Geijskes (1963).

6. There are $6\frac{1}{2}$ antenodal cross veins in the fore-wing (**Fig. 3.2.191**). The coloration of the male is very bright, with the dorsal surface of the frons shiny greenish black. Its thorax is bright blue with yellow dorsal and lateral markings. The male abdomen is black with yellow lateral markings on the fourth through sixth segment and yellow apices of the anal appendages. The coxa, trochanter, and base of the femur of the male are yellowish brown, and the rest of the legs are black. The coloration of the female is much duller, with a shiny orange patch on the dorsal surface of the frons, a light reddish brown thorax with obscure olive greenish markings, and a dark brown abdomen with reddish brown basal

segments, lateral markings, and apices of the anal appendages. The legs are mainly black with large sections of the femora light brown. The wings of both sexes are hyaline with blackish veins and dark brown pterostigmas.

.....*Micrathyria romani* Sjöstedt, 1918
(Ecuador, Peru, Amazonas).

- There are 7 ½ antenodal cross veins in the fore-wing (**Fig. 3.2.194**). The male has pale yellow mouth parts, a light bluish face, dark metallic blue frons and vertex, brown occipital triangle, and yellow inflated part of the occiput. The abdomen of the male is black with blue markings. Total length: 24 to 25 mm. Length of abdomen without appendages: 15.5 to 17 mm. Hind wing length: c. 19 mm.

.....*Micrathyria coropinae* Geijskes, 1963
(Surinam).

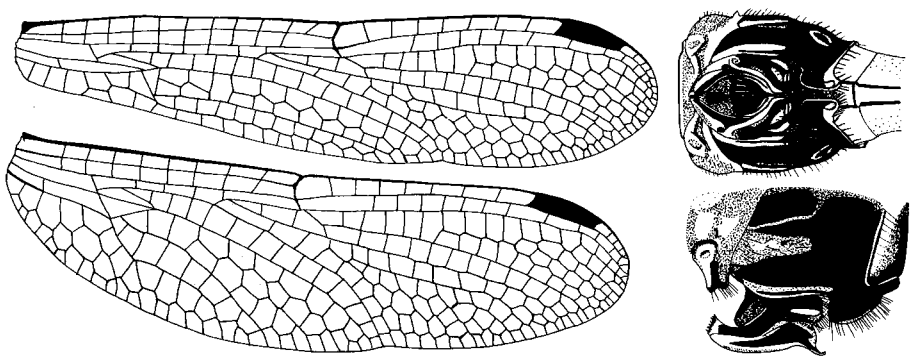


Fig. 3.2.192 *Micrathyria dido*: fore and hind wing (left) and the male genitalia on the second abdominal segment in ventral (upper right) and lateral view (lower right). Based on Ris (1911a).

7. The superior anal appendages of the male are equal to or shorter than the combined length of the ninth and tenth abdominal segments (**Fig. 3.2.193**).8
- The male superior anal appendages are longer than the combined length of the ninth and tenth abdominal segments (**Fig. 3.2.195**).13
8. The inferior anal appendage extends a distance posteriad equal to or greater than the superior appendage.9
- The superior anal appendage obviously extends farther posteriad than the inferior appendage (**Fig. 3.2.196**).10

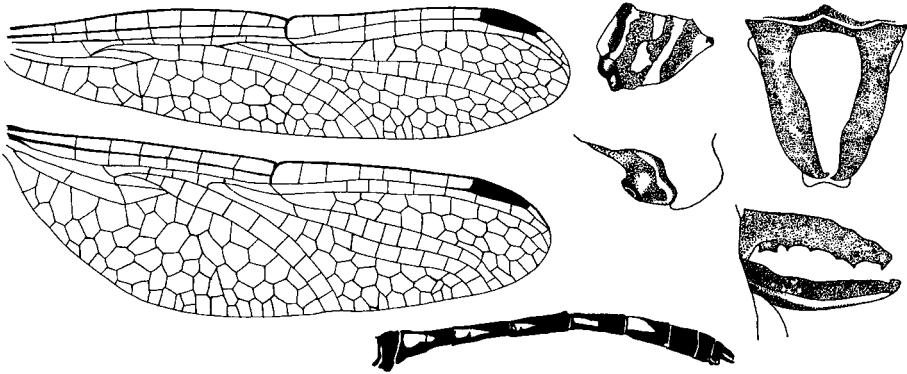


Fig. 3.2.193 *Micrathyria eximia* male: fore and hind wing (left), lateral color pattern on the thorax (upper right center) and on the abdomen (lower center), hamule and genital lobe in lateral view (right center), superior anal appendages of the male in dorsal view (upper right), and anal appendages of the male in lateral view. Based in part on Westfall (1992).

9. The inferior anal appendage is slightly longer than the superior appendage, which has apical points directed toward one another. The ventral surface of the superior appendage has a roughly evenly-spaced row of coarse teeth from near the base to the apex. The hamule is shorter than the genital lobe, which curves anteriad over it at the apex (**Fig. 3.2.193**). There are $7\frac{1}{2}$ antenodal cross veins in the fore-wing, and 6 in the hind wing. Total length: 22 to 26 mm. Length of pterostigma: c. 2 mm. The thorax is bluish pruinose with yellow stripes, and the abdomen is black with yellow lateral markings on the third through eighth segment.

.....*Micrathyria eximia* Kirby, 1897
(Argentina, São Paulo, Mato Grosso, Rondônia).

- The superior and inferior anal appendages of the male are about of equal length, and the row of coarse teeth on the ventral side of the superior appendage begins more than $\frac{1}{3}$ of the way from the base to the apex, which has acute points directed posteriad. The hamule is clearly longer than the genital lobe (**Fig. 3.2.197**). The triangles in both the fore and hind wing are not crossed. There are $7\frac{1}{2}$ antenodal cross veins in the fore-wing and 6 or 7 in the hind wing. The head of the male is metallic black on the occiput, vertex, and dorsal part of the frons, with the black marking in the middle almost reaching the anteclypeus. The vertex and dorsal parts of the frons of the female are light brown, and the occiput is dark brown. The lateral parts of the frons are greenish yellow in the male and light brown in the female. The labium and ventral part of the face are cream, and there is a slight yellowish tinge to the labrum. The compound eyes of living male dragonflies are reportedly greenish or brownish red. The head of the

female is dark brown on the occiput and light brown on the vertex and upper surface of the frons. The ventral 2/3 of the fore-femur of the female is cream. The thorax is mainly dark brown with obscure lighter markings, which are more prominent in the female. The coxae, trochanters, and a basal stripe on the fore-femur are yellow or light brown or partially cream in the female, and the rest of the legs are dark brown or black. The abdomen is dark brown or black with small lighter lateral spots at the bases of the fourth and fifth segments and lighter stripes on the seventh segment in the male and more extensive lighter markings in the female. Total length with appendages: 26.5 to 28 mm. Length of abdomen: 17 to 19.5 mm. Hind wing length: c. 21.5 mm.

.....*Micrathyria dunklei* Westfall, 1992
(Rondônia).

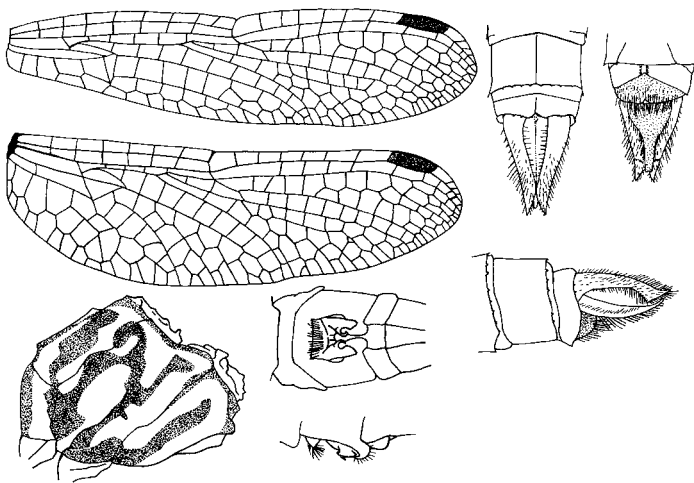


Fig. 3.2.194 *Micrathyria coropinae* male: fore and hind wing (upper left), color pattern on the thorax in lateral view (lower left), genitalia on the second abdominal segment in ventral and lateral view (lower center, above and below, respectively), and apex of the abdomen in dorsal (upper right center), ventral (upper right), and lateral view (lower right). Based on Geijskes (1963).

10. The greatest width of the inferior anal appendage of the male is considerably more than 2.5 times the width at the apex (**Fig. 3.2.196**). In ventral view, the superior anal appendages are strongly bent at midlength, and there is a double row of denticles on the ventral side. On the “sole” of the boot-shaped anal loop in the hind wing, there are three cells. Length of male abdomen: 17 to 18 mm. Hind wing length of the male: 20 to 21.5 mm.

.....*Micrathyria kleerekoperi* Calvert, 1946
(São Paulo).

- The greatest width of the inferior anal appendage of the male is less than 2.5 times the width at the apex, or, if not, the superior anal appendage is not sharply flexed at midlength but rather evenly arched as far as the subapical ventral angle (Fig. 3.2.198).11

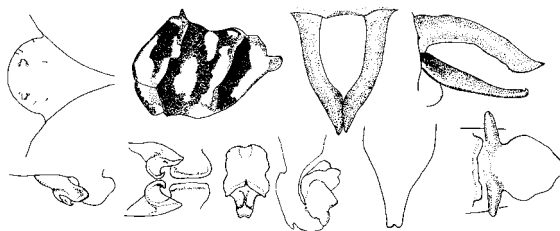


Fig. 3.2.195 *Micrathyria occipita* (upper row, left to right): occiput of a male, lateral color pattern on the thorax of a male, superior anal appendages of the male in dorsal view, anal appendages of the male in lateral view, and (below, left to right): hamule and genital lobe on the second abdominal segment of the male in lateral and ventral view, penis in ventral and lateral view, inferior anal appendage of the male in ventral view, and female vulvar lamina in ventral view. Based on Westfall (1992).

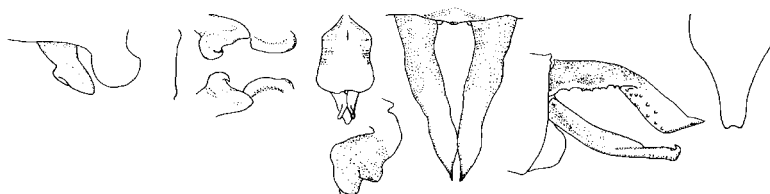


Fig. 3.2.196 *Micrathyria kleerekoperi* male (left to right): lateral view of the hamule and genital lobe on the second abdominal segment in lateral and ventral view, penis in ventral (above) and lateral view (below), superior anal appendages in dorsal view, anal appendages in lateral view, and inferior anal appendage in ventral view. Based on Westfall (1992).

11. The abdomen of the male is dull black with yellow lateral markings on the third through seventh segments. The yellow marking on the seventh segment is larger and much more prominent than the others and occupies most of the anterior third of the segment. The yellow markings on the abdominal segments of the female are larger, but that on the seventh segment is also considerably larger than the others. The pterostigma is about 2 mm long. In the fore-wing, the two rows of cells running from the distal side of the triangle in the fore-wing toward the wing margin increases to three rows at about the level of the first postnodal cell. The wings are not darkened at the bases. The face is yellow, and only the apices of the mandibles are free. The thorax of the male is predominantly

metallic violet black, but the pleurae of the female are mainly yellow with reddish brown separating the large yellow bands. The coloration of the male is much darker than that of the female. The dorsal surface of the frons and much of the thorax is shiny dark bluish with yellowish markings on the anterior part of the thorax. The legs are black, and the wings are lightly tinged with amber and have brown veins. The female has a dull yellow thorax with light brown markings. The female abdomen is mainly brownish black with the first three segments mostly yellow and yellow lateral markings on the fourth through seventh segments. The wings of the female are hyaline with blackish veins. The pterostigma of both sexes is dark reddish brown. The wing span is from 40 to 42 mm (**Fig. 3.2.199**).

.....*Micrathyria tibialis* Kirby, 1897
(Central America, Ecuador, Peru, Venezuela, Guyana, French Guiana, Surinam, Paraguay, Bolivia, Argentina, Pernambuco, Pará to Mato Grosso and Rio Grande do Sul).

- The light marking on the seventh abdominal segment is not notably larger than those on other segments, or the light markings occupy more than 1/3 of the area of the segments. The markings on the thorax are variable (**Fig. 3.2.198**).12

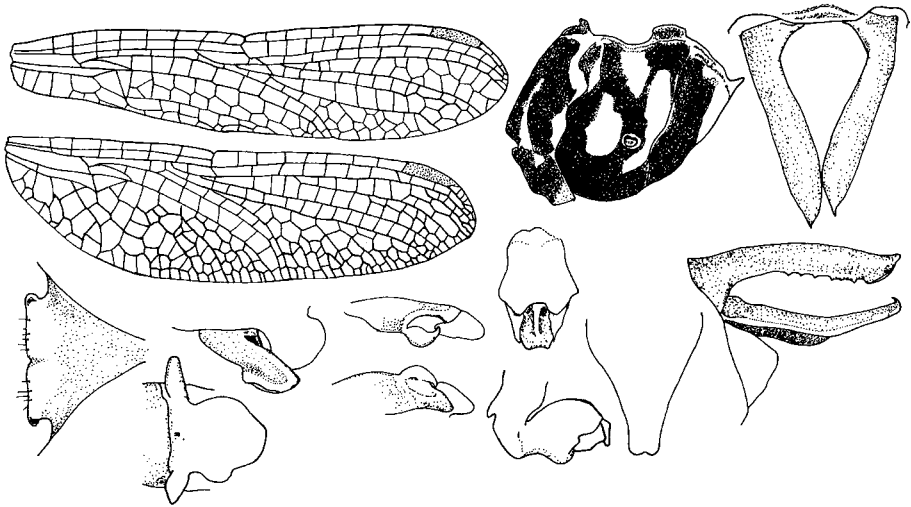


Fig. 3.2.197 *Micrathyria dunklei*: fore and hind wing (upper left), lateral color pattern on the thorax of a male (upper center), occiput of a female (lower left), male hamule and genital lobe in lateral and ventral view (middle left center, left and right, respectively), penis in ventral and lateral view (lower center, above and below, respectively), superior anal appendages of a male in dorsal view (upper right), anal appendages of a male in lateral view (lower right), inferior anal appendage of the male in ventral view (lower right center), and the female vulvar lamina (lower left center). Based mainly on Westfall (1992).

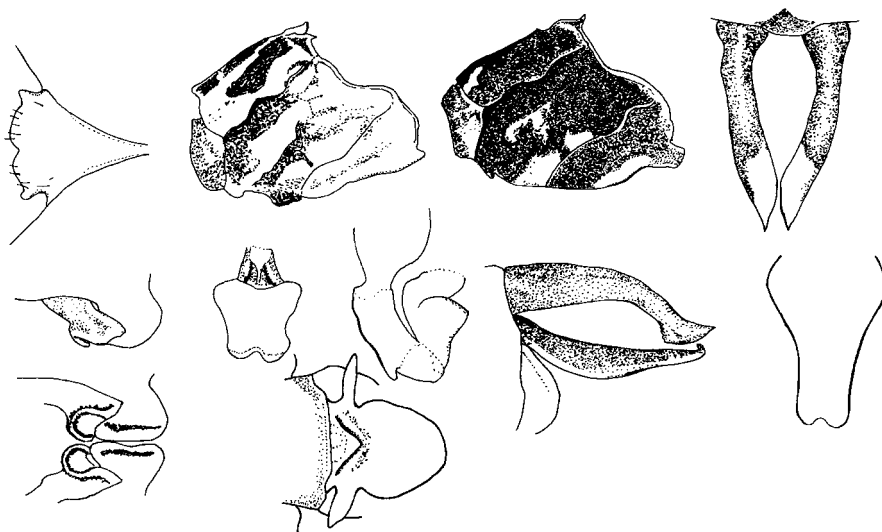


Fig. 3.2.198 *Micrathyria pseudeximia* (upper row, left to right): occiput of a male, lateral color pattern on the thoraces of two different males, superior anal appendages of the male in dorsal view, and (below, left to right): hamule and genital lobe on the second abdominal segment of a male in lateral (above) and ventral view (below), penis in dorsal and lateral view (above) and female vulvar lamina in ventral view (below), anal appendages of the male in lateral view, and inferior anal appendage of the male in ventral view. Based on Westfall (1992).

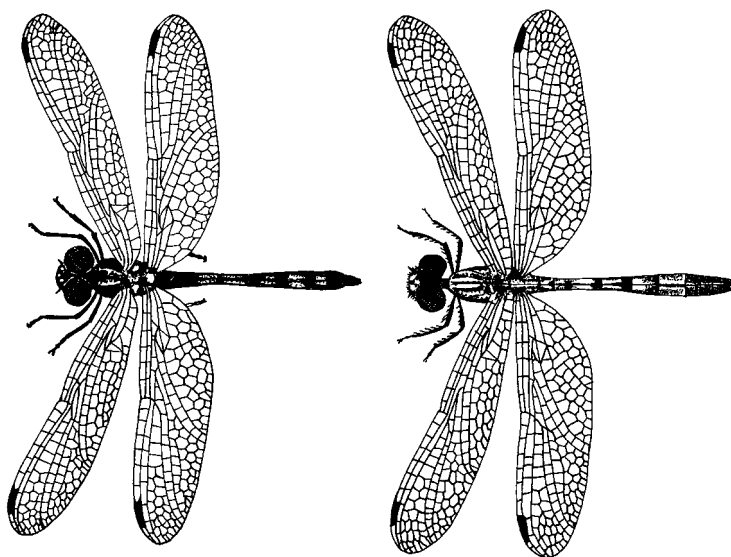


Fig. 3.2.199 Habitus of a male (left) and female *Micrathyria tibialis* (right). The wing veins are not well depicted. Based on Kirby (1897).

12. The abdomen of the male is black with greenish yellow markings on the third and sixth through eighth segments, and that of the female has light markings that form a broad, nearly continuous stripe on the second through seventh segments. The head of the male is shiny black with a pair of bright yellow spots on the occiput and metallic blue on the vertex and dorsal part of the frons, with the blue almost reaching the postclypeus. The vertex and dorsal parts of the frons of the female are light brown, and the occiput is shiny dark brown. The lateral parts of the frons are greenish yellow in the male. The labium of both sexes is bright yellow, and the rest of the face is greenish yellow. The head of the female is shiny dark brown on the occiput and light brown on the vertex and upper surface of the frons. The ventral 2/3 of the fore-femur of the female is cream; the rest of the femurs, tibiae, and tarsi are dark brown or black. The pattern on the thorax is variable (**Fig. 3.2.198**). Total length with appendages: 24 to 25 mm. Length of abdomen: 14 to 19 mm. Hind wing length: 18 to 20 mm.

.....*Micrathyria pseudeximia* Westfall, 1992
(Central America, Trinidad, Colombia, Ecuador, Peru, Venezuela, Surinam, French Guiana, Bolivia, Paraguay, Pará, Amazonas, Maranhão, Espírito Santo, Rio de Janeiro, Paraná, Minas Gerais, Goiás, Mato Grosso).

- The abdomen of the male is dark brown or black with extensive greenish yellow markings in the first through seventh segments, while that of the female is dark brown or black with lateral tan stripes running the length of the first eight segments and a pale dorsal marking on the tenth segment. The superior anal appendages of the male are dark basally and yellow on the apical half, and they bear a single row of denticles on the ventral surface. The vertex of the male is shiny brown, and an area around the middle ocellus is shiny dark brown or black with a bluish tinge. The coloration of the female is lighter. The rest of the face is greenish yellow. The labium is yellow with brown margins of the middle and lateral lobes. In the female, this brown coloration may be diffuse. The prothorax is brown and bright yellow, and the synthorax is brown or black with extensive greenish yellow markings (**Fig. 3.2.200**). The coxae and trochanters are somewhat pale, and the remaining parts of the legs, except for the fore-femur, are black. The basal half of the fore-femur of the male is greenish yellow, while the ventral side of the fore-femur of the female is entirely white. The wings are hyaline. Total length including appendages: c. 30 mm. Length of abdomen: 18.5 to 21 mm. Hind wing length: 20.5 to 23.5 mm.

.....*Micrathyria divergens* Westfall, 1992
(Minas Gerais).

13. The ventral angle on the superior anal appendage is located about $\frac{3}{4}$ of the way from the base to the apex. The abdomen of the male is black with extensive pale bluish markings on the second through seventh segments, while that of the female is reddish brown with more yellowish than blue markings, which include a large pair of light markings on the second segment that meet in the middle, pale lateral stripes along the entire lengths of the third and fourth segments, and shorter stripes on the fifth through seventh segments. The entire thorax and appendages of the male are black, except for about six bluish gray lateral stripes

on the pleurae (**Fig. 3.2.195**). The color pattern of the female is similar to that of the male, but with reddish brown and yellow instead of black and blue. The wings are hyaline with black veins, and the pterostigma is black.

.....*Micrathyria occipita* Westfall, 1992
(Ecuador, Peru).

- The ventral angle on the superior anal appendage is located about midlength or in the basal half (**Fig. 3.2.201**).14

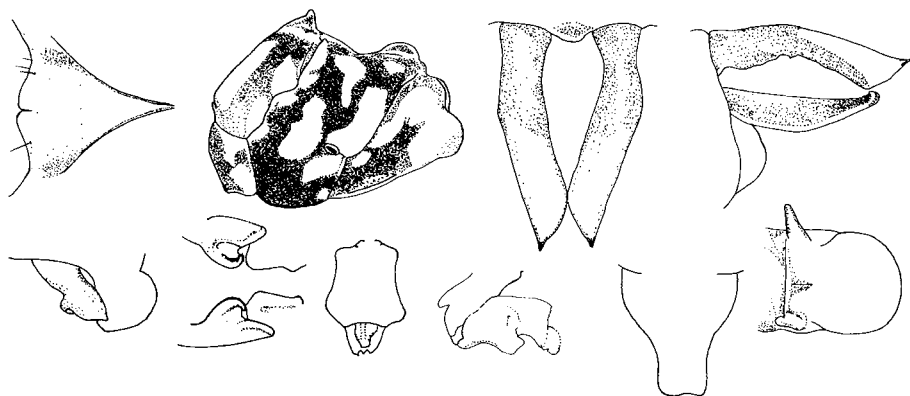


Fig. 3.2.200 *Micrathyria divergens* (upper row, left to right): occiput of a male, lateral color pattern on the thorax of a male, superior anal appendages of the male in dorsal view, anal appendages of the male in lateral view, and (below, left to right): hamule and genital lobe on the second abdominal segment of the male in lateral and ventral view, penis in ventral and lateral view, inferior anal appendage of the male in ventral view, and female vulvar lamina in ventral view. Based on Westfall (1992).

14. The superior anal appendage are about 2.5 mm long, and its apical-most tooth, as seen in lateral view, is located in the proximal third (**Fig. 3.2.201**). In dorsal view, the middle antehumeral stripe forms a T. There are yellow-orange markings on the lateral surfaces of the first through seventh abdominal segments that form a stripe interrupted at each junction of the segments. Length of abdomen: 16 to 17 mm. Hind wing length: c. 20 mm.

.....*Micrathyria spuria* (Selys, 1900)
(Venezuela, Paraguay, Argentina, Paraná, Rio de Janeiro, São Paulo, Minas Gerais, Mato Grosso, Mato Grosso do Sul). Syn: *Anatya spuria* Selys, 1900; *Micrathyria macrocercis* Calvert, 1909.

- The superior anal appendage is about 2.0 mm long, and its apical-most tooth, as seen in lateral view, is located at about mid-length (**Fig. 3.2.202**). There are $7\frac{1}{2}$ or, rarely, $8\frac{1}{2}$ antenodal cross veins. In dorsal view, the middle antehumeral

stripe is interrupted and does not form a T. Length of abdomen: c. 17 mm. Hind wing length: c. 21 mm. Male chromosome number: $2n = 25$, $n = 13$ (Ferreira *et al.*, 1979).

.....*Micrathyria hesperis* Ris, 1911
(Venezuela, Argentina, Pará, Piauí, Ceará, Pernambuco, Bahia, Espírito Santo, Minas Gerais, Rio de Janeiro, São Paulo, Paraná, Santa Catarina, Rio Grande do Sul, Goiás, Mato Grosso, Mato Grosso do Sul).

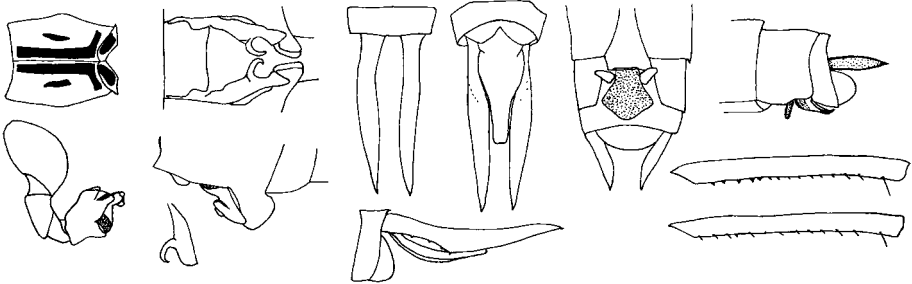


Fig. 3.2.201 *Micrathyria spuria* (above, left to right): color pattern on the thorax of a male, genitalia on the second abdominal segment in ventral view, apex of the male abdomen in dorsal and ventral view, apex of a female abdomen in ventral and lateral view, and (below, left to right): penis in lateral view, male genitalia in lateral view, hamule in frontal view (below genitalia), apex of the male abdomen in lateral view, and the hind femur of a male (above) and female (below). Based on Santos (1946a).

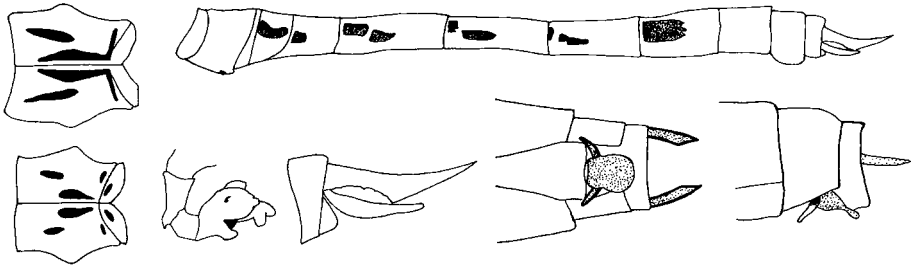


Fig. 3.2.202 *Micrathyria hesperis* (above) color pattern on the dorsal surface of the male thorax (left) and color pattern on the abdomen of a male in lateral view (right), and (below, left to right) varying color pattern on the thorax of another male, penis in lateral view, apex of the abdomen of a male in lateral view, and apex of the female abdomen in ventral and lateral view. Based on Santos (1946a).

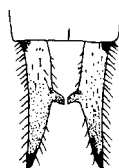


Fig. 3.2.203 Apex of the abdomen of a male *Micrathyria mengeri* in dorsal view. Based on Costa *et al.* (2002).

15. The hamule has a small hook-like posterior branch and a large anterior branch with short, thickened setae at the apex, which extends far anterior to the anterior margin of anterior lamina and ends ventral to the first abdominal segment. In ventral view, this anterior branch of the hamule narrows toward the apex, and in lateral view, it appears parallel-sided. In lateral view, the superior anal appendage is curved in the distal third without forming a sharp angle. There are at least $10\frac{1}{2}$ antenodal cross veins in the fore-wing. The anal loop in the hind wing is very small, consisting of only about six cells (**Fig. 3.2.192**). The frons is shiny bluish black. The thorax is light brown with large yellow markings covering most of the lateral surface. The abdomen is black with yellow lateral markings on the first through seventh segments and on the ventral side of the seventh through ninth segments. The wings are hyaline with dark veins, and the pterostigma is black.

.....*Micrathyria dido* Ris, 1911
(Peru, Venezuela, French Guiana, Surinam, Argentina, Brazil).

- The anterior branch of the hamule does not extend as far anterior as the anterior lamina or does not end ventral to the first abdominal segment, or the anal loop in the hind wing consists of more than six cells (**Fig. 3.2.204**).16
16. In dorsal view, two tubercles are apparent along the internal margin near the midlength of each superior anal appendage (**Fig. 3.2.203**). The frons is shiny bluish black. The thorax is dark brown with reddish brown lateral stripes. The legs are dull black. The wings of the male have a faint yellowish tint on the basal half, black veins in the hyaline parts, and brown veins where the membrane is tinted. The wings of the females are hyaline with black veins. The pterostigma is black or dark brown. The abdomen, including the anal appendages, is black with a pair of grayish triangles on the basal part of the seventh segment of the male and yellow lateral or ventral markings on the first through seventh segments of the female.

.....*Micrathyria mengeri* Ris, 1919
(Central America, Trinidad, Colombia, Ecuador, Peru, Venezuela, Guyana, Surinam, French Guiana, Maranhão, Goiás, Espírito Santo, Minas Gerais, Rio de Janeiro). Two subspecies have been described: *Micrathyria mengeri mengeri* Ris, 1919; and *Micrathyria mengeri watsoni* Dunkle, 1995.

- In dorsal view, no tubercles are apparent on the superior anal appendages (**Fig. 3.2.204**).17

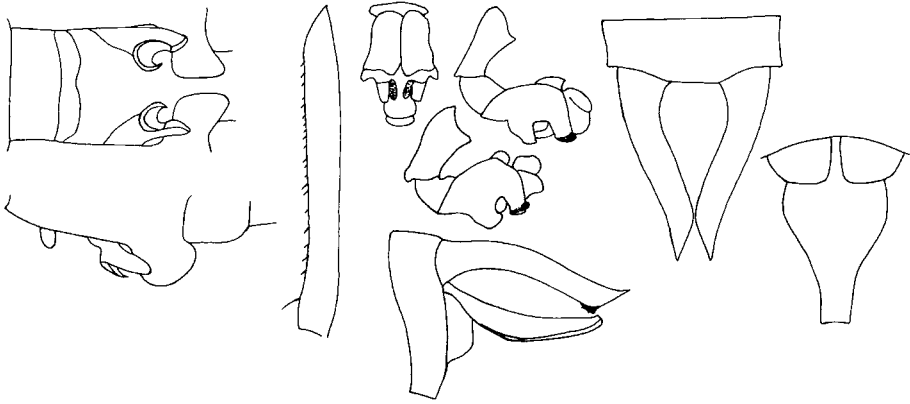


Fig. 3.2.204 *Micrathyria iheringi* male: genitalia on the second abdominal segment in ventral (upper left) and lateral view (lower left), hind femur in lateral view (left center), penis in ventral view (left of center, above) and those of two specimens in lateral view (above right of center and center), apex of the abdomen in dorsal view showing only the superior anal appendages (upper right center), inferior anal appendage in ventral view (right), and apex of the abdomen in lateral view (lower center). Based on Santos (1946b).

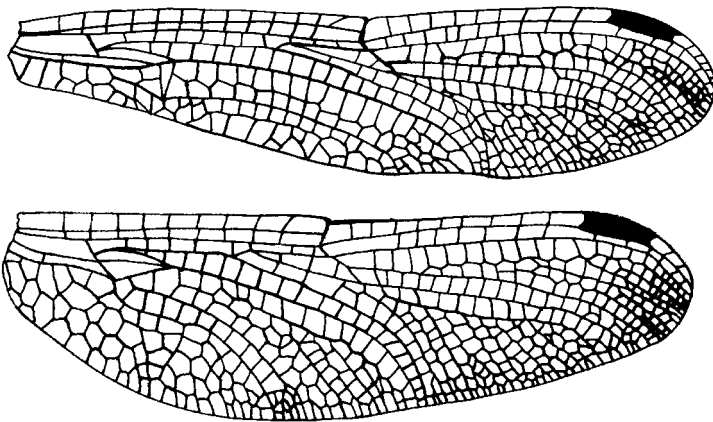


Fig. 3.2.205 Fore and hind wing of *Micrathyria hippolyte*.

17. There are $11\frac{1}{2}$ or $12\frac{1}{2}$ antenodal cross veins in the fore-wing (**Fig. 3.2.205**), and the abdomen of the male is dark reddish brown with darker bands at the margins of the segments. The superior anal appendage is dark reddish brown or light brown, and the inferior appendage is yellowish or light brown. The male is mainly reddish brown with lighter and darker markings and a large green lateral marking on the thorax. The wings are hyaline with black veins and brown pterostigmas. The compound eyes, parts of the femora, the tibiae, and the tarsi are blackish. The female has a similar color pattern, but the colors are paler.

.....*Micrathyria hippolyte* Ris, 1911
(Ecuador, Peru, Venezuela, Guyana, Surinam, French Guiana, Brazil).

- Most species have no more than $10\frac{1}{2}$ antenodal cross veins in the fore-wing, but if there are as many as $11\frac{1}{2}$ such veins, then the abdomen of the male is mainly black, or the legs are brownish with three longitudinal yellow markings on the femora.18

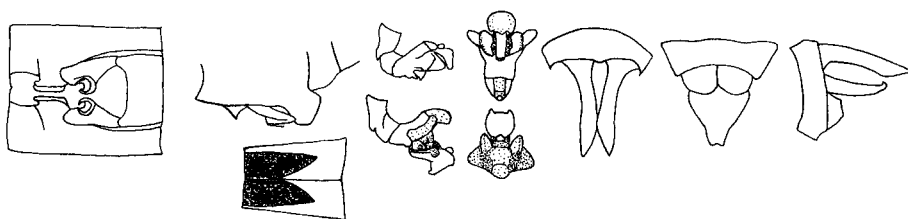


Fig. 3.2.206 *Micrathyria longifasciata* male (left to right): genitalia on the second abdominal segment in ventral and lateral (above) view, color pattern on the dorsal surface of the seventh abdominal segment (below genitalia), penis in lateral and in ventral view closed (above) and open for copulation (below), and the apex of the abdomen in dorsal, ventral, and lateral view. Based on Santos (1946c).

18. The frons, clypeus, and labium are pale blue, and the labrum is cream colored. There are three cells in the subtriangle and two cells in the triangle of the fore-wing. The thorax is dull brown with pale greenish markings, and the abdomen is mainly dark brown with two pale dorsal stripes on the first through sixth and eighth and ninth segments, a pale blue spot on each side of the seventh segment, and a pair of yellow stripes on the ventral side of all segments. The color of senescent males becomes increasingly pruinose. The anterior lamina of the male genitalia on the second abdominal segment is rudimentary, and the hamule and genital lobe extend almost an equal distance ventrad. Length of abdomen: 19 to 24 mm. Hind wing length: 24.5 to 30 mm.

.....*Micrathyria schumanni* Calvert, 1906
(Central America, Venezuela).

- The frons, clypeus, and labium are not pale blue. The labium is usually black, brown, yellow, greenish, or combinations of colors.19
- 19. In dorsal view, the superior anal appendage is somewhat constricted along its length, and in lateral view, one or two rows of denticles are always evident along its ventral surface (**Fig. 3.2.206**).20
- The superior anal appendage of the male is not obviously constricted anywhere along its entire length (**Fig. 3.2.207**).23
- 20. The pterostigma is at least 3.5 mm long. The sub-triangle usually consists of 3 cells, and the triangle, of 2 cells. In the fore-wing, 10 or rarely 11 antenodal cross veins are present. There is barely any darkening at the base of the hind wing. The labium is mainly yellow with a black band across its median third. The thorax and abdomen of the male are black and pruinose, while the abdomen of the female is mainly yellow, becoming brown toward the apex. Length of abdomen: 22.5 to 26 mm. Length of hind wing: 27 to 31.5 mm.*Micrathyria athenais* Calvert, 1909 (Mato Grosso).
- The pterostigma is less than 3.0 mm long. The triangle is usually not crossed, or, if it is, the hind wing is less than 30 mm long.21

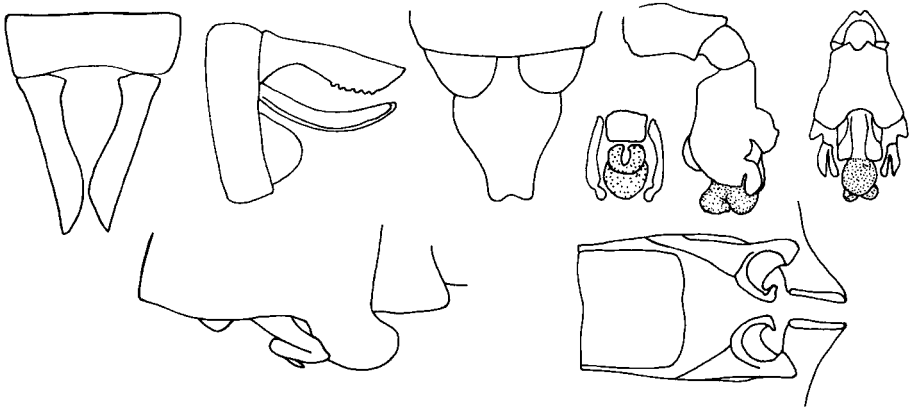


Fig. 3.2.207 *Micrathyria unglata* (upper row, left to right): apex of the male abdomen showing the superior anal appendages in dorsal and lateral view and the inferior anal appendages in ventral view; the penis in apical, lateral, and ventral view; and (lower row, left to right): the genital structures on the second abdominal segment in lateral and ventral view. Based on Santos (1953b).

21. In dorsal view, the superior anal appendages are narrowed in the basal third and widen again about 2/3 of the way to the apex (**Fig. 3.2.206**). The abdomen of the male narrows continually from the first to the anterior margin of the fourth segment. It then widens to the posterior margin of the seventh segment and then narrows again to the apex. There are 7½ or occasionally 8½ antenodal

cross veins in the fore-wing and 6 or 7 in the hind wing. Length of abdomen: c. 23 mm. Hind wing length: c. 25 mm. Pterostigma length: 2.6 mm. Coloration: Clypeus and frons pale green; a metallic blue marking on the vertex, which is large in the male and small in the female; labium yellow with black lateral lobes; occiput shining black with yellow markings posterior to each compound eye in the male and reddish brown with yellow markings in the female. The thorax is brown with green stripes. The abdomen of the male is black with pruinosity at the base and on the fourth and fifth segments, a pair of yellow dorsal spots on the anterior part of each segment, and a lateral stripe on each side of the posterior part. There is a large yellow marking on the seventh abdominal segment. The first three abdominal segments of the female are green with black sutures and carinae. The yellow markings on the other segments are larger than those of the male.

.....*Micrathyria longifasciata* Calvert, 1909
(Bolivia, Paraguay, Argentina, Mato Grosso do Sul, Mato Grosso).

- In dorsal view, the superior anal appendages are narrowed about 2/3 of the way from the base to the apex, and in lateral view, 2 to 8 teeth in a row are evident on the apical third of the appendage (**Fig. 3.2.208**). The triangle is usually free.22

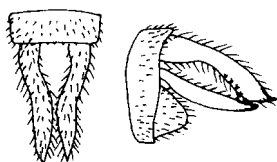


Fig. 3.2.208 *Micrathyria stawiarskii* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Costa *et al.* (2002).

22. The pterostigma is 2.8 mm long. There are 8½ to 10½ antenodal cross veins in the fore-wing and a row of 6 to 8 teeth on the ventral surface of the superior anal appendage of the male (**Fig. 3.2.208**). Length of abdomen: 22.5 mm. Length of hind wing: 26 mm.

.....*Micrathyria stawiarskii* Santos, 1953
(Federal District, Goiás, Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo, Paraná, Santa Catarina, Rio Grande do Sul).

- The pterostigma is about 2.0 mm long. There are about two teeth near the apex on the ventral surface of the superior anal appendage that are visible in lateral view (**Fig. 3.2.209**). The seventh to tenth abdominal segments are widened. Total length of male: 25.5 to 27 mm; female: c. 23 mm. Length of male abdomen: 17 to 17.5 mm; female: 14.5 mm. Length of hind wing of male: 21 to 22 mm; female: c. 20 mm. Color: male mainly black with yellow mouthparts, a pair of yellow spots on the seventh abdominal segment, sometimes brown on the thorax, and a bluish metallic sheen on the black in places; female with less

intense metallic sheen and more extensive yellow markings, including a yellow band across the antealar crest.

.....*Micrathyria paruensis* Geijskes, 1963
(French Guiana, Surinam, Pará?).

23. The superior anal appendages of the male are not obviously sigmoid, and in dorsal view, their outer margins are straight. The labium is narrowly black on the apical margin but yellow in the center. There is an indistinct yellowish color at the base of the hind wing (**Fig. 3.2.207**). There are $8\frac{1}{2}$ to $10\frac{1}{2}$ antenodal cross veins in the fore-wing. Length of abdomen: 21 to 23 mm. Hind wing length: c. 28 mm. Length of pterostigma in the fore-wing: 2.5 to 3 mm.

.....*Micrathyria unguolata* Förster, 1907
(Peru, Argentina, Paraná, São Paulo, Mato Grosso). Syn: *Dythemis gerula* Hagen, 1861 (*nomen nudum*).

- In dorsal view, the superior anal appendages of the male are obviously curved, and their outer margins do not appear straight (**Fig. 3.2.204**).24

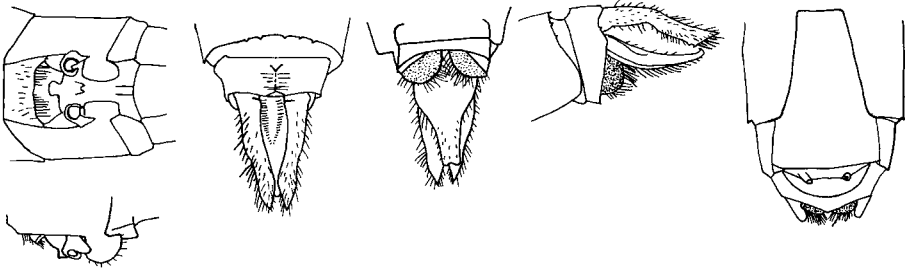


Fig. 3.2.209 *Micrathyria paruensis* (left to right): male genitalia on the second abdominal segment in ventral (above) and lateral view (below); apex of the male abdomen in dorsal, ventral, and lateral view; apex of the female abdomen in ventral view. Based on Geijskes (1963).

24. The labium is entirely black, or it has two pairs of tiny yellow spots laterally. In dorsal view, the superior anal appendages of the male are sinuate, and the teeth that are visible in lateral view form a plate (**Fig. 3.2.210**). There is a distinct basal spot on the hind wing. In the fore-wing, the triangle is free, and there are from 8 to $10\frac{1}{2}$ antenodal cross veins. Length of abdomen: 23 mm. Hind wing length: c. 28 mm. Length of pterostigma in the fore-wing: 3.35 to 3.50 mm.

.....*Micrathyria pirassunungae* Santos, 1953
(Distrito Federal, Goiás, Espírito Santo, Minas Gerais, Rio de Janeiro, São Paulo, Mato Grosso).

- The labium is not entirely black or predominantly black with two small yellow spots. The hind wings have golden yellow clouds at the base, and both wings may have yellowish brown or black shading distal to the pterostigma.25

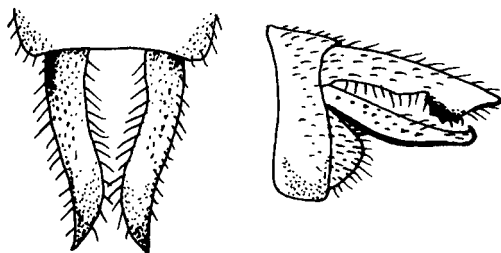


Fig. 3.2.210 *Micrathyria pirassunungae* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Costa *et al.* (2002).

25. The prothorax is brown or ochraceous, and the synthorax is covered by a bluish pruinosity. The labium is entirely yellow or yellow with the internal margins blackened. The occiput is almost black. The abdomen of the male is dark brown with a bluish pruinosity, and that of the female is brown with narrow yellow lateral stripes. The triangle is not crossed. There are $7\frac{1}{2}$ to $9\frac{1}{2}$ antenodal cross veins in the fore-wing and 6 to 8 in the hind wing. The superior anal appendage has a small subapical group of denticles on the ventral side (**Fig. 3.2.204**). Length of abdomen: 18 to 21 mm. Hind wing length: 23 to 24 mm. Length of pterostigma: c. 2.5 mm.

.....*Micrathyria iheringi* Santos, 1946
(Ecuador, São Paulo, Espírito Santo).

- The thorax of the male is predominantly dark with incomplete greenish stripes or yellow markings (**Fig. 3.2.211**). The subtriangle in the fore-wing is crossed and divided into two cells, but the triangle is free.26

26. The thorax of the male is predominantly dark with incomplete green bands.

.....*Micrathyria aequalis* (Hagen, 1861)
(Central America, West Indies, Colombia, Ecuador, Venezuela, Guyana, French Guiana, Surinam). Syn: *Dythemis aequalis* Hagen, 1861; *Micrathyria septima* Selys, 1900.

- The prothorax, synthorax, and abdomen of the male are black with yellow markings and some green on the anterior abdominal segments. The triangle is not crossed. There are $8\frac{1}{2}$ antenodal cross veins in the fore-wing and 7 in the hind wing. The inner side of the labial lobes and outer margin of the labrum are narrowly darkened, but the rest of the mouthparts are yellow. The superior anal appendages of the male are sharply bent in the proximal $\frac{1}{3}$ and then run straight to their convergence at the apices; they bear a row of denticles on the ventral side (**Fig. 3.2.211**). Total length: 26 to 28 mm. Length of male abdomen with appendages: 18 to 19 mm; female abdomen: c. 16.5 mm. Hind wing length: 22 to 22.5 mm. Length of pterostigma: c. 2.5 mm.

.....*Micrathyria surinamensis* Geijskes, 1963
(French Guiana, Surinam).

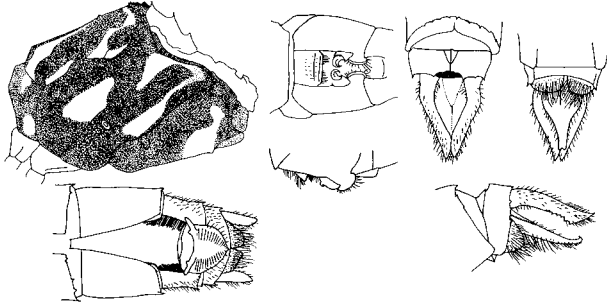


Fig. 3.2.211 *Micrathyria surinamensis*: color pattern on the lateral surface of the synthorax (upper left); male genitalia on the second segment of the abdomen in ventral (upper left center) and lateral view (center); apex of the male abdomen in dorsal (upper right center), ventral (upper right), and lateral view (lower right); apex of the female abdomen in ventral view (lower left). Based on Geijskes (1963).

27. The hamule is small and inconspicuous, not extending below or branching over either the anterior lamina or genital lobe (**Fig. 3.2.212**).28
 - The hamule is large and conspicuous, clearly extending below the anterior lamina and genital lobe (**Fig. 3.2.213**).33

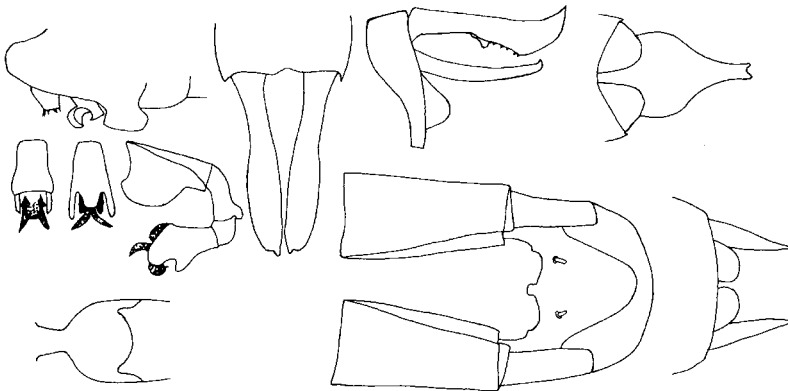


Fig. 3.2.212 *Micrathyria ocellata dentiens* (above, left to right): male genitalia on the second abdominal segment in lateral view, superior anal appendages of the male in dorsal and lateral view, inferior anal appendage of the male in ventral view, and (middle left, left to right): penis in dorsal, ventral, and lateral view, and (below, left to right): the anterior lamina of a male, eighth and ninth segments of the female abdomen in ventral view, and anal appendages of a female in ventral view. Based on Santos (1949b).

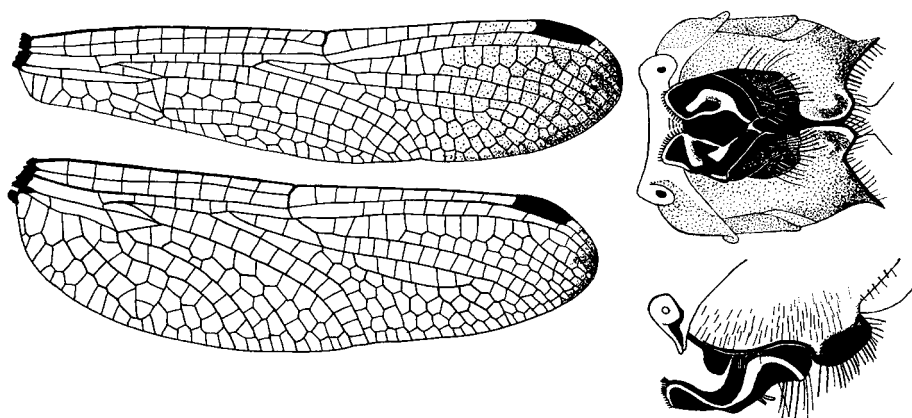


Fig. 3.2.213 *Micrathyria dictynna*: fore and hind wing (left) and the male genitalia on the second abdominal segment in ventral (upper right) and lateral view (lower right). Based on Ris (1919).

28. In lateral view, the superior anal appendage has a tooth at about mid-length on the ventral surface that is more prominent than the others (**Fig. 3.2.212**). The male genital lamina has rounded lobes with tiny spines. The third through sixth abdominal segments are cylindrical, and the seventh through ninth are widened. A yellow mark covers most of the seventh abdominal segment.

.....*Micrathyria ocellata* Martin, 1897
(Central America, Trinidad, Colombia, Ecuador, Peru, Venezuela, Guyana, Surinam, French Guiana, Bolivia, Argentina, Acre, Pará, Maranhão, Ceará? Pernambuco, Bahia, Espírito Santo, Minas Gerais, Rio de Janeiro, São Paulo, Paraná, Santa Catarina, Mato Grosso do Sul, Mato Grosso). Three subspecies have been described: *Micrathyria ocellata ocellata* Martin, 1897; *Micrathyria ocellata quicha* Calvert, 1909; and *Micrathyria ocellata dentiens* Calvert, 1909. A synonym for *M. o. dentiens* is *Micrathyria carlota* Needham, 1942.

- There is no tooth on the ventral surface of the superior anal appendage (**Fig. 3.2.214**).29

29. The genital lamina of the male, which is anterior to the hamule on the ventral side of the second abdominal segment, extends ventrad as a pointed triangle and is larger than the hamule. The inferior anal appendages extend as far as the apical-most tooth on the superior appendage (**Fig. 3.2.214**). The wings are hyaline with distinct yellowish basal spots, that on the fore-wing not reaching vein *cac* and that on the hind wing reaching it. The labium is yellow or grayish yellow with black in the middle and on the lobes. In both males and females, the

triangles are not crossed, but the subtriangles are usually crossed so that they consist of two cells or rarely one or three. There is a broad orange-yellow strips occupying most of the dorsal surface of the abdomen. Length of abdomen: c. 25 mm. Hind wing length: 25 to 27 mm. Length of pterostigma: 3 to 3.2 mm.

.....*Micrathyria catenata* Calvert, 1909
(Central America, Trinidad, Ecuador, Peru, Venezuela, Surinam, French Guiana, Argentina, Pará, Amazonas, Espírito Santo, Minas Gerais, São Paulo, Rio de Janeiro, Santa Catarina, Bahia, Pernambuco, Maranhão, Goiás, Federal District, Mato Grosso, Mato Grosso do Sul).

- The genital lamina of the male does not appear larger than the hamule (**Fig. 3.2.215**).30

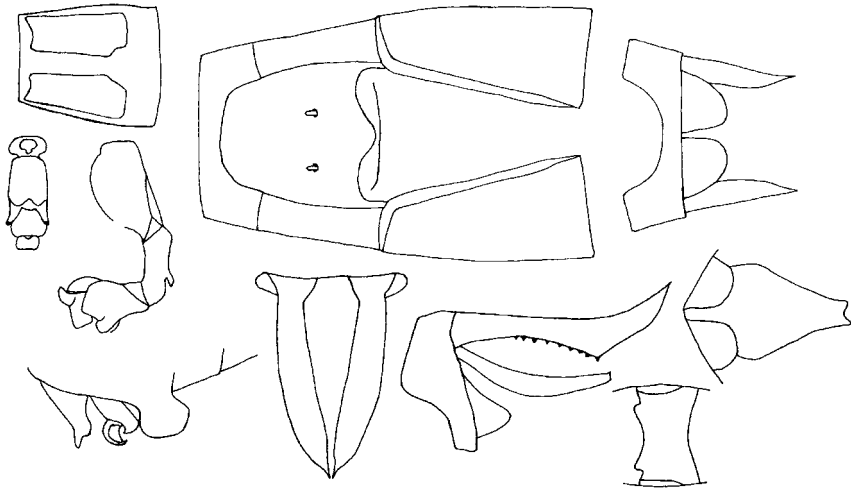


Fig. 3.2.214 *Micrathyria catenata*: markings on the seventh abdominal tergite of a male (upper left), ventral view of the sixth and seventh abdominal segments of a female (upper center), ventral view of the ninth abdominal segment of a female (upper right), the penis in dorsal and lateral view (middle left, left and right, respectively), male genitalia on the second abdominal segment in lateral view (lower right), anal appendages of a male in dorsal (lower left center) and lateral view (lower right center), inferior anal appendage in ventral view (middle right), and anterior lamina (lower right center). Based on Santos (1949b).

30. In dorsal view, the superior anal appendages of the male converge at their apices, and in lateral view, a row of teeth is visible on the ventral surface (**Fig. 3.2.215**). In the fore-wing, there are 8 to 11 cells in the radial supplement.

.....*Micrathyria almeidai* Santos, 1945
(Goiás, Federal District, Minas Gerais, São Paulo, Rio de Janeiro).

- In dorsal view, the superior anal appendages diverge at their apices (**Fig. 3.2.216**).31

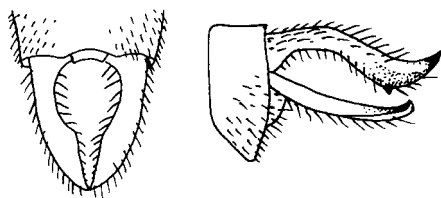


Fig. 3.2.215 *Micrathyria almeidai* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Costa *et al.* (2002).

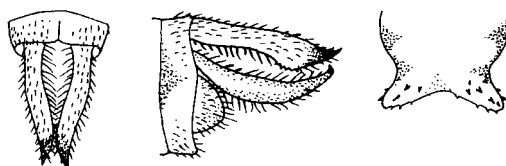


Fig. 3.2.216 *Micrathyria atra* male (left to right): apex of the abdomen in dorsal and lateral view and the apex of the genital lamina. Based on Costa *et al.* (2002).

31. The male genital lamina is bilobed with small spines on each lobe. In lateral view, the superior anal appendages appear only slightly curved (**Fig. 3.2.216**). There is a small yellowish marking at the base of the hind wing; the apices of the wings are amber, and the remainder of the membrane is hyaline. The veins and pterostigmas are black. The frons of the male is shiny bluish black. The rest of the head and thorax are brown with light brown or cream lateral stripes on the thorax.. The first five segments of the male abdomen are dark red with narrow black borders between the segments. The sixth and seventh segments are dark red on the proximal part and black on the posterior 1/4 to 1/3. The apical three segments and anal appendages are black. The legs are black from the bases of the femora.

.....*Micrathyria atra* (Martin, 1897)
(Central America, Trinidad, Ecuador, Peru, Venezuela, Guyana, French Guiana, Surinam, Argentina, Pará, Amazonas, Amapá, Bahia, Pernambuco, Espirito Santo, Rio de Janeiro, Mato Grosso). Syn: *Dythemis atra* Martin, 1897.

- The male genital lamina is not bilobed, but there are small, rounded lateral protuberances at the apex. In lateral view, the superior anal appendages are obviously curved along the middle section (**Fig. 3.2.217**). There is a small brownish marking at the base of the hind wing.32

32. The inferior anal appendage is nearly straight, curving only slightly near the apex, which reaches almost to the apex of the superior appendage (**Fig. 3.2.217**).

The frons of the male is shiny bluish black. The thorax and abdomen of the male are mainly black with yellow lateral markings on the thorax and paired brownish dorsal markings on the anterior abdominal segments. The legs are almost entirely black. The yellow markings on the abdomen are brighter in teneral males and tend to fade with age. Male chromosome number: $2n = 25$, $n = 13$ (Ferreira *et al.*, 1979).

.....*Micrathyria artemis* Ris, 1911
(Peru, Venezuela, Guyana, French Guiana, Surinam, Argentina, Rio de Janeiro, São Paulo, Espírito Santo, Minas Gerais, Amapá, Pará, Amazonas, Mato Grosso).

- The inferior anal appendage curves through about 45° and reaches only slightly beyond the point the superior appendage makes its strong curve dorsad. In both males and females, the triangle in the fore-wing consists of two cells. The labrum and labium are both entirely pale yellowish green. The superior anal appendage of the male is evenly curved inward but the apices diverge slightly (**Fig. 3.2.80**). Total length of male and female: about 37.2 mm; female: Length of male abdomen with appendages: about 26.2 mm; female abdomen: about 25.3 mm. Fore-wing length: about 28.5 to 30 mm; hind wing length of male: about 28.7 mm; female: 25.1 mm. The pterostigma of the fore-wing is 2.7 to 3.0 mm long.

.....*Micrathyria ringueleti* Rodrigues, 1988
(Argentina).

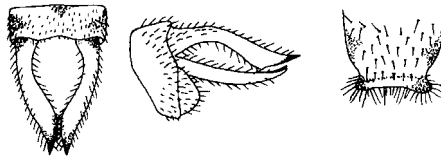


Fig. 3.2.217 *Micrathyria artemis* male (left to right): apex of the abdomen in dorsal and lateral view and the apex of the genital lamina. Based on Costa *et al.* (2002).

33. The hamule extends anteriad beyond the anterior margin of the genital lamina (**Fig. 3.2.213**).34

- The hamule may extend as far anteriad as but does not extend beyond the anterior margin of the genital lamina (**Fig. 3.2.218**).39

34. In lateral view, the anterior branch of the hamule appears rounded, and it lacks spines. In dorsal view, the superior anal appendages of the male are parallel, and the bases are slightly dilated; in lateral view, their apices curve dorsad. The inferior anal appendage extends beyond the apical tooth on the superior appendage (**Fig. 3.2.219**).

.....*Micrathyria borgmeieri* Santos, 1947
(Espírito Santo, Rio de Janeiro, São Paulo, Paraná).

- In lateral view, the anterior branch of the hamule appears quadrangular, and it bears spines (**Fig. 3.2.213**).35

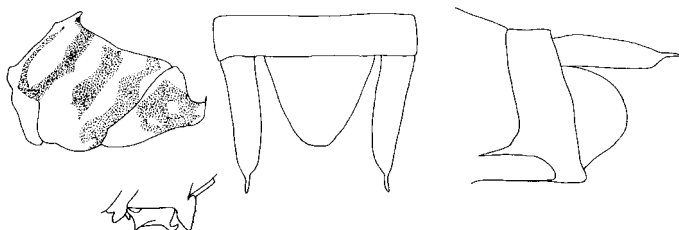


Fig. 3.2.218 *Micrathyria spinifera* (left to right): color pattern on the lateral surface of the synthorax of a female (above), male genitalia on the second abdominal segment in lateral view (below), and the apex of the female abdomen in dorsal and lateral view. Based on Calvert (1909b) and Santos (1965a).

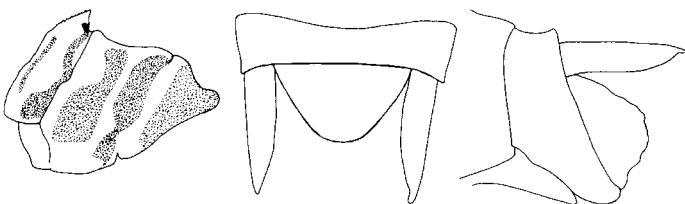


Fig. 3.2.219 *Micrathyria borgmeieri* female (left to right): color pattern on the lateral surface of the synthorax and the apex of the abdomen in dorsal and lateral view. Based on Santos (1965a).

35. The outer processes of the hamule extend anteriad to a point below the thorax and bear six or seven sharp, strong ventral setae (**Fig. 3.2.213**). The superior anal appendages of the male are straight and bear five or six teeth along the ventral margin. On the eighth abdominal segment of the male, there is a pair of round, greenish yellow spots on the dorsum.

.....*Micrathyria dictynna* Ris, 1919
(Central America, Ecuador, Venezuela).

- The outer processes of the hamule extend anteriad only as far as a point beneath the first abdominal segment, and they bear short setae only at the anterior end (**Fig. 3.2.220**).36

36. The superior anal appendages are straight in lateral view, bear four strong teeth on the ventral surface, and are slightly longer than the inferior appendage. The apex of the inferior appendage is emarginated and nearly half as wide as the widest point of the appendage. The outer processes of the dark brown or black hamules extend anteriad to the middle of the first abdominal segment, where the apices converge. Each bears eight to ten black, tooth-like spines on the anterior margin (**Fig. 3.2.220**). The eighth abdominal segment lacks round, greenish

yellow spots on each side of the dorsal midline. Total length of male: c. 36.5 mm; female: c. 33 mm. Length of male abdomen: c. 25 mm; female: c. 23 mm. Hind wing length of male: c. 26 mm; female: 25.5 mm. Color: mainly blackish brown and black with green or yellowish green markings. The wings of the male are hyaline, and those of the female are somewhat smoky.

.....*Micrathyria sympriona* Tennessen, 2000
(Ecuador, Peru).

- In either dorsal or lateral view, the superior anal appendages of the male are either obviously curved or sinuous (**Fig. 3.2.221**). The subtriangle in the fore-wing is divided into three cells.37



Fig. 3.2.220 *Micrathyria sympriona* (upper row, left to right): occiput of a female in dorsal view, color pattern on the thorax of a male in dorsal and lateral view, and the vulvar lamina on the ninth abdominal segment of a female in ventral view, and (middle row, left to right): the ocellar region and occiput of a male in dorsal view, the accessory male genitalia on the second abdominal segment in lateral view, the penis in lateral view, and the anal appendages of a male in dorsal view, and (lower row, left to right): the genital lobes and hamules of a male in ventral view, the anal appendages of a male in lateral view, and the inferior anal appendage of a male in ventral view. Based on Tennessen (2000).

37. The wings are yellowish at the base and considerably darkened at the apices. The labium is buff with a black suture on the mentum. The mandibles are black. The superior anal appendages of the male appear sinuate in both dorsal and lateral view. The occiput is ferrugineous with yellow spots and streaks. The prothorax is brassy green with a narrow yellow line laterally, and much of the rest of the thorax is bluish black with black sutures and yellow pleural stripes.

There are $11\frac{1}{2}$ or $12\frac{1}{2}$ antenodal cross veins in the fore-wing (**Fig. 3.2.222**). The abdomen is mainly shiny black with an anterior transverse green marking on the second segment, green lateral markings on the third and fourth segments, orange lateral spots on the fifth and sixth segments, and an oval green marking on the seventh segment. The legs are black with ventral yellow markings at the bases of the femora. Total length: c. 34 mm. Length of pterostigma: c. 3. mm.

.....*Microthyria cambridgei* Kirby, 1897
(French Guiana, Amazonas, Pará).

- The wings have ochraceous markings at the base but are usually hyaline or only slightly clouded at the apices. In lateral view, the basal 2/3 of the ventral margin of the superior anal appendage of the male is obviously concave, and its dorsal margin above it is correspondingly convex as far as the prominent ventral tooth 2/3 of the way from the base to the apex. The width of the inferior anal appendage at its apex is no more than about 1/3 of its width at the widest point (**Fig. 3.2.221**).38

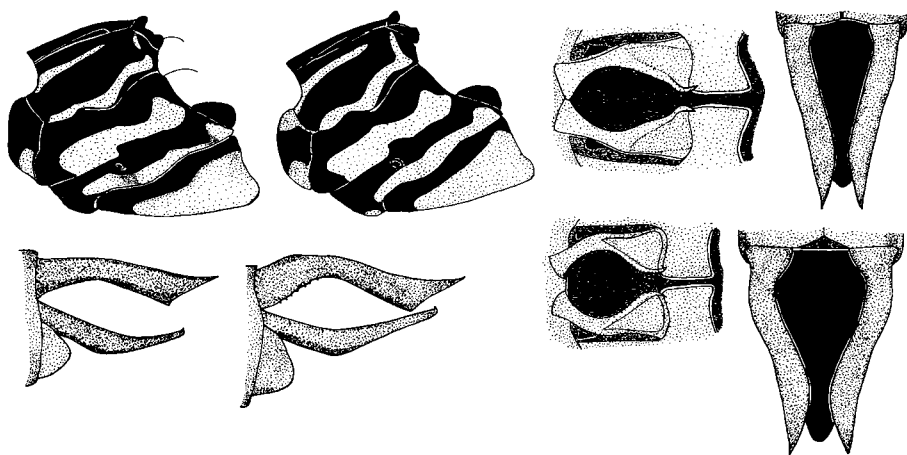


Fig. 3.2.221 *Microthyria didyma* male: patterns on the lateral surface of the thoraces of two specimens (upper left), genitalia on the second abdominal segment of two specimens in ventral view (right center), and the apices of the abdomen of two specimens in dorsal (right) and lateral view (lower left). Based on West Indian specimens illustrated by Donnelly (1970).

38. The apex of the inferior anal appendage of the male is rounded, and its width is about 1/4 of its maximum basal width. The dorsal margin of the superior anal appendage of the male becomes concave above the ventral tooth in the apical 1/3. In dorsal view, the superior anal appendages of the male diverge; in lateral view, each curves at a sharp angle in its distal third and extends far beyond the apex of the inferior appendage (**Fig. 3.2.221**). The outer processes of the

hamules are not light tan. There are three cells in the subtriangle of the fore-wing. The dorsal surface of the head is light brown. There is a green metepisternal stripe that is wider than the dark metepisternal stripe.

.....*Micrathyria didyma* (Selys in Sagra, 1857)
(Central America, West Indies, Colombia, Ecuador, Venezuela, Guyana, Surinam, French Guiana, Pernambuco, Espirito Santo, Rio de Janeiro). Syn: *Libellula didyma* Selys in Sagra, 1857; *Dythemis dicrota* Hagen, 1861; *Mesothemis poeyi* Scudder, 1866; *Micrathyria pruinosa* Kirby, 1894.

- The apex of the inferior anal appendage of the male is slightly emarginate, and its width is more than 1/4 but not more than 1/3 of its maximum width (**Fig. 3.2.223**). The outer processes of the hamules are light tan. There are small teeth on the ventral side of the superior anal appendage in some specimens and not in others, and the angle in the distal third of the appendage may be nearly rounded off. There are 9½ or 10½ antenodal cross veins in the fore-wing. Total length without appendages: 33 to 37.5 mm. Length of abdomen without appendages: 21.5 to 25.5 mm. Hind wing length: 25.5 to 30.5 mm. Length of pterostigma: 3.0 to 3.2 mm. The yellow labium has a wide black middle band. The dorsal part of the frons and vertex is metallic blue, and the occipital triangle is shiny black. The synthorax is black with yellow markings.

.....*Micrathyria venezuelae* DeMarmels, 1989
(Ecuador, Venezuela).

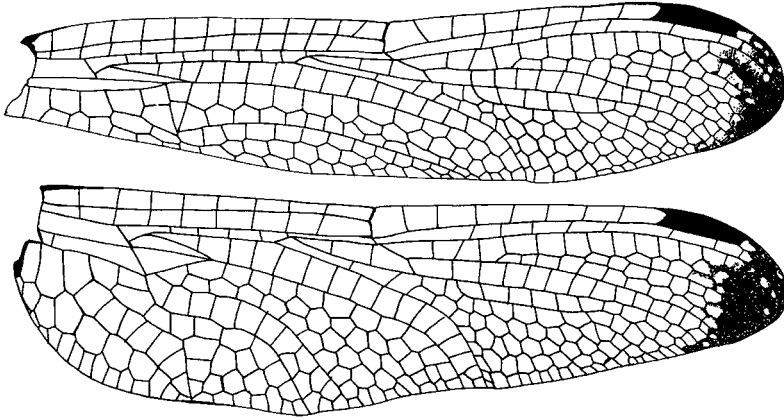


Fig. 3.2.222 Fore and hind wing of *Micrathyria cambridgei*. Based on Ris (1919).

39. In lateral view, the hamule is longer along the body axis than wide on the dorsoventral axis, and its posteroventral branch forms a hook-like process at the apex (**Fig. 3.2.218**).40

- The hamule is narrow, and neither of its terminal branches points ventrad; at its apex it forms a spine rather than a hook (**Fig. 3.2.224**).41

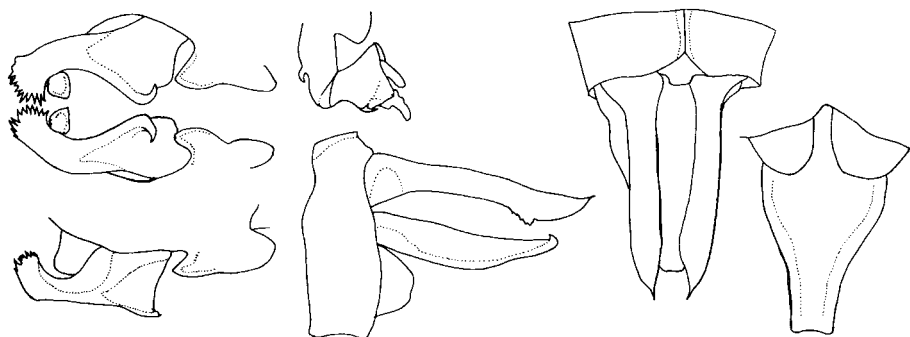


Fig. 3.2.223 *Micrathyria venezuelae* male: genitalia on the second abdominal segment in ventral (upper left) and lateran view (lower left), penis in lateral view (upper left center), apex of the abdomen in dorsal (right center) and lateral view (lower center), and inferior anal appendage in ventral view (right). Based on DeMarmels (1989a).

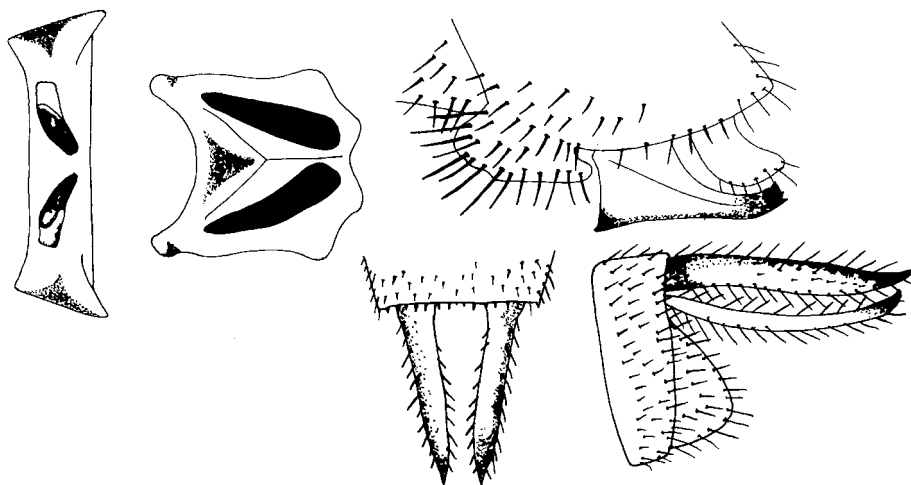


Fig. 3.2.224 *Micrathyria hypodidyma* male: first abdominal segment in ventral view (left); metasternum in ventral view (left center); lateral view of the male genitalia on the second abdominal segment, oriented with the right side of the illustration toward the head (upper right); the apex of the abdomen in dorsal (lower center) and lateral view (lower right). Based on Costa *et al.* (2002).

40. The anterior lamina is vestigial, but there is an enlargement on the ventral side of the first abdominal segment that resembles an anterior lamina. At its anterior end, the hamule forms two spine-like processes directed generally cephalad but somewhat divergent, one extending dorsad to contact the much-reduced anterior lamina and the other ventrad. Each hamule has a longitudinal groove along its entire length, which is evident in ventral view (**Fig. 3.2.218**). The eighth and ninth abdominal segments are slightly dilated and about the same length as the superior anal appendages. There is no single cell that extends from vein M_4 to Cu_1 . The discoidal triangle in the fore-wing is not crossed. Hind wing length of male: c. 27 mm. Length of pterostigma along the costa: c. 2.5 mm. Coloration of the male: head yellow ventrally and brownish with slight bluish reflections dorsally. The thorax is shiny dark brown with greenish blue iridescence and green markings. The abdomen is blackish with small green or yellow markings on the first through sixth segments, and a large yellow marking covering about half of the seventh segment.

.....*Micrathyria spinifera* Calvert, 1909
(Trinidad, Ecuador, Peru, Venezuela, Guyana, Surinam, French Guiana, Bolivia, Rio de Janeiro, Espirito Santo, Federal District, Amapá, Pará, Amazonas).

- The anterior lamina is not vestigial, and there is no enlargement on the ventral side of the first abdominal segment that resembles an anterior lamina (**Fig. 3.2.225**). The discoidal triangle in the fore-wing is not crossed. Length of male abdomen: c. 28.5 mm; female: c. 24 mm. Hind wing length of male: c. 33.5 mm; female: c. 30 mm. Length of stigma along the costa: 2.8 to 3.0 mm. Coloration of the male: head greenish yellow ventrally with narrow black borders on the labium; the upper part of the frons and the vertex are metallic blue. The occiput is pale green on the posterior surface and brown on the dorsal surface. The thorax is brown with a narrow yellow antehumeral stripe on each side and a greenish yellow lateral surface with three brown stripes. The abdomen is mainly brown, somewhat darkening distad, with greenish yellow covering most of the first two segments and extending as lateral stripes on the third through seventh segments.

.....*Micrathyria dythemoides* Calvert, 1909
(Trinidad, Ecuador, Peru, Surinam).

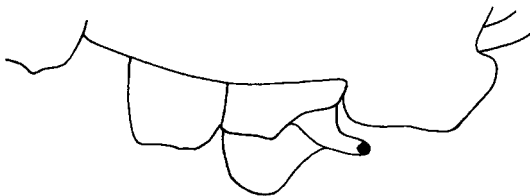


Fig. 3.2.225 Male genitalia of *Micrathyria dythemoides* on the second abdominal segment in lateral view. The specimen on which the figure was based was damaged and probably lacks an anterior portion of the hamule. Based on Calvert (1909b).

41. On the ventral surface of the first abdominal segment, there are two plates bearing teeth. The anterior branch of the hamule reaches the anterior margin of the genital lamina. In dorsal view, the superior anal appendages of the male are parallel, and in lateral view, they extend only slightly beyond the apices of the inferior appendage (**Fig. 3.2.224**). At least one cell reaches from vein M_4 to Cu_1 in the hind wing. In the fore-wing, there are 3 cells in the triangle, 2 or 3 cells in the subtriangle, 12 antenodal, and 9 or 10 postnodal cross veins. The frons is metallic blue. There are two broad, dark stripes shaped somewhat like drops on the lateral surface of the metasternum. A pair of round, greenish yellow spots are present just dorsal to the lateral carina on the ninth abdominal segment of the male.

.....*Micrathyria hypodidyma* Calvert, 1906
(Bolivia, Paraguay, Uruguay, Argentina, Rio Grande do Sul, Santa Catarina, Paraná, Rio de Janeiro, São Paulo, Espírito Santo, Minas Gerais, Federal District, Goiás, Bahia). Syn: *Micrathyria protoe* Förster, 1907; *Micrathyria didyma hypodidyma* Calvert, 1906.

- There are no plates bearing teeth on the ventral surface of the first abdominal segment. The triangle in the fore-wing is crossed once or twice, dividing it into two or three cells (**Fig. 3.2.190**).42

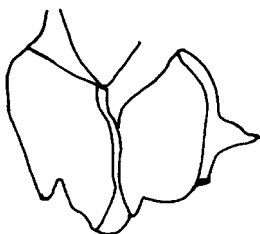


Fig. 3.2.226 Apex of the penis of *Micrathyria laevigata* in lateral view. Based on Tennessen (2000).

42. The triangle in fore-wing is divided into two cells. There is not a single cell that reaches from vein M_4 to Cu_1 in the hind wing. In the fore-wing, there are 12 antenodal, and 9 or 10 postnodal cross veins. In the fore-wing, there are usually two cells in the triangle, and the discoidal triangle is free. There are 12 antenodal and 9 or 10 postnodal cross veins in the fore-wing. The frons of the male is shiny bluish black, and that of the female is shiny orange with a small bluish black marking. The compound eyes are reddish brown. The thorax is dark brown to black with two broad yellow stripes across the lateral surface. The legs are black apical to the bases of the femora. The wings are tinged with yellow or amber and have black veins and pterostigmas. The abdomen is black with a pair of fairly large yellow markings at the base of the seventh segment. The apex of the penis has only one sclerotized lobe directed ventrad (**Fig. 3.2.226**). Length of

the male abdomen: c. 24.5 mm; female: c. 21 mm. Hind wing length of male: c. 29 mm; female: 27 to 29 mm.

.....*Micrathyria laevigata* Calvert, 1909 (Central America, Trinidad, Colombia, Ecuador, Peru, Venezuela, Mato Grosso do Sul, São Paulo). Syn: *Micrathyria didyma laevigata* Calvert, 1909. Originally described by Calvert (1909b) as subspecies, there is no fully reliable way to distinguish the two nominal species in this couplet. That these are valid species is highly doubtful.

- The triangle in the fore-wing is divided into three cells. In dorsal view, the superior anal appendages are not parallel, and in lateral view, they clearly extend beyond the inferior appendage (**Fig. 3.2.190**). The frons is greenish.

.....*Micrathyria pseudhypodidyma* Costa, Lourenço, and Viera, 2002 (Bolivia, Paraguay, Uruguay, Argentina, Rio Grande do Sul, Santa Catarina, Paraná, Rio de Janeiro, São Paulo, Espírito Santo, Minas Gerais, Federal District, Goiás, Bahia).

Key to the species of known *Micrathyria* larvae in South America

Information for the key was provided by Santos (1968b, 1972, 1978a), Rodrigues Capítulo (1988), Assis and Costa (1994), and Needham *et al.* (2000). The larvae of most species remain undescribed, so the key is far from complete.

1. The paraproct is more than twice as long as the epiproct. The cerci are about 2/3 as long as the epiproct (**Fig. 3.2.227**).2
- The paraproct is usually about 1½ times as long as the epiproct and always obviously shorter than twice as long (**Fig. 3.2.228**).4

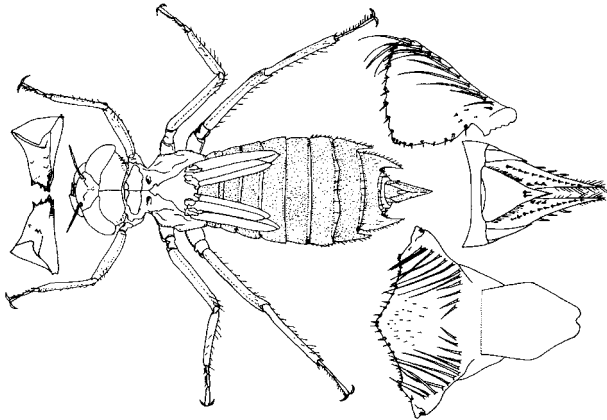


Fig. 3.2.227 *Micrathyria borgmeieri* larva: habitus from exuvia (center), prementum (lower right), mandibles (left), right labial palp (upper right), and caudal appendages (middle right). Based on de Assis and Costa (1994).

2. There are nine or ten setae on each labial palp proximal to the movable hook (Fig. 3.2.229). The ventral side of the abdomen is pale with a double row of tiny round dots.

.....*Micrathyria aequalis* (Hagen, 1861)
(Central America, West Indies, Colombia, Ecuador, Venezuela, Guyana, French Guiana, Surinam). Syn: *Dythemis aequalis* Hagen, 1861; *Micrathyria septima* Selys, 1900.

- There are 10 long setae and one small one on each labial palp proximal to the movable hook and 11 to 13 long setae on each side of the prementum (Fig. 3.2.227).3

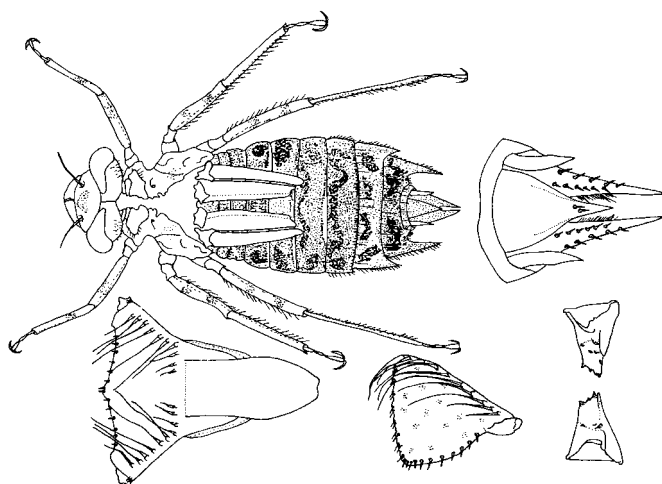


Fig. 3.2.228 *Micrathyria mengeri* larva: habitus from exuvia (upper left), prementum (lower left), mandibles (lower right), right labial palp (lower center), and caudal appendages (upper right). Based on Assis and Costa (1994).

3. The color is rather uniform ochraceous. The posterior margins of the seventh through ninth abdominal segments are lined with long, robust setae (Fig. 3.2.227). Total length of final instar: c. 16.5 to 17.5 mm.

.....*Micrathyria borgmeieri* Santos, 1947
(Espírito Santo, Rio de Janeiro, São Paulo, Paraná).

- There is a pattern of darker markings on the thorax and abdomen. There are 10 crenulations on the distal margin of the labial palp. The lateral spine on the ninth abdominal segment extends as far posteriad or slightly farther than the epiproct (Fig. 3.2.230). Total length of final instar: c. 20 mm.

.....*Micrathyria artemis* Ris, 1911
(Peru, Venezuela, Guyana, French Guiana, Surinam, Argentina, Rio de Janeiro, São Paulo, Espírito Santo, Minas Gerais, Amapá, Pará, Amazonas, Mato Grosso).

4. Each cercus is about half as long as the epiproct. The posterior margins of the apical abdominal segments are not lined with long, robust setae. Near the distal margin of the lateral palp, there is a cluster of a few brown spots. The general color is yellowish with an obscure pattern of lighter and darker markings. The number of long setae on each side of the prementum is 12, and there are 12 long setae and one small one on each labial palp proximal to the movable hook (Fig. 3.2.231). Total length of final instar: c. 19 mm.

.....*Micrathyria ocellata* Martin, 1897
(Central America, Trinidad, Colombia, Ecuador, Peru, Venezuela, Guyana, Surinam, French Guiana, Bolivia, Argentina, Acre, Pará, Maranhão, Ceará? Pernambuco, Bahia, Espírito Santo, Minas Gerais, Rio de Janeiro, São Paulo, Paraná, Santa Catarina, Mato Grosso do Sul, Mato Grosso). Three subspecies have been described: *Micrathyria ocellata ocellata* Martin, 1897; *Micrathyria ocellata quicha* Calvert, 1909; and *Micrathyria ocellata dentiens* Calvert, 1909. A synonym for *M. o. dentiens* is *Micrathyria carlota* Needham, 1942.

- Each cercus is at least 2/3 as long as an epiproct (Fig. 3.2.228).5
5. There is a row of about 14 setae on each side of the prementum and a row of about 11 long setae proximal to the movable hook on each labial palp. The lateral spines on the ninth abdominal segment curve inward. The entire body has a pattern of light and dark areas, including dark bands on the legs (Fig. 3.2.232).

.....*Micrathyria ringueleti* Rodrigues, 1988
(Argentina).

- There are no more than 13 premental setae on each side, and the lateral spine on the ninth abdominal segment extends more posteriad than inward (Fig. 3.2.228).6

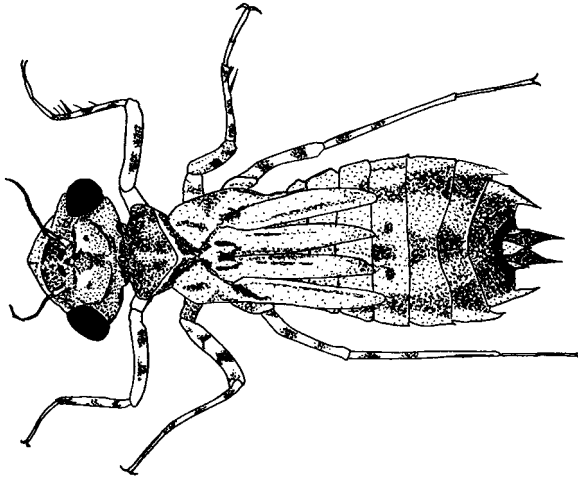


Fig. 3.2.229 Habitus of a *Micrathyria aequalis* larva. Based on Needham *et al.* (2000).

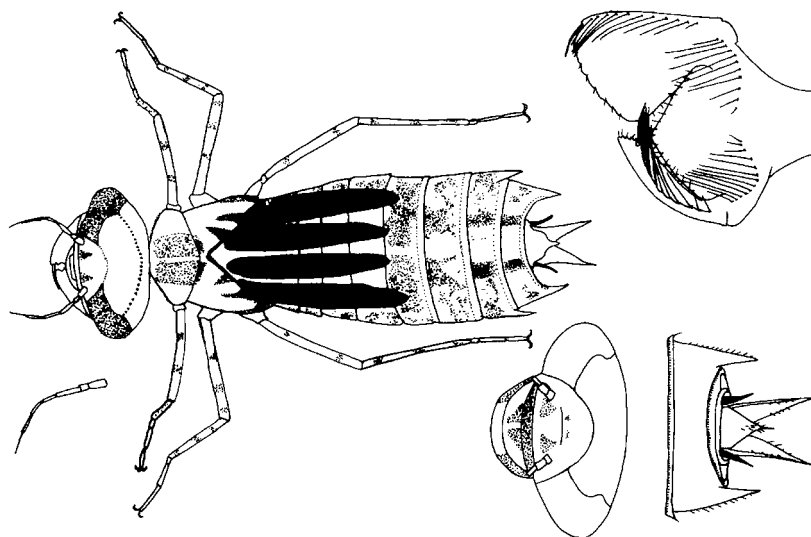


Fig. 3.2.230 *Micrathyria artemis* larva: habitus from an exuvia (upper left), antenna (lower left), labium in dorsal view (upper right), head in dorsal view (lower right center), and caudal appendages in dorsal view (lower right). Based on Santos (1972).

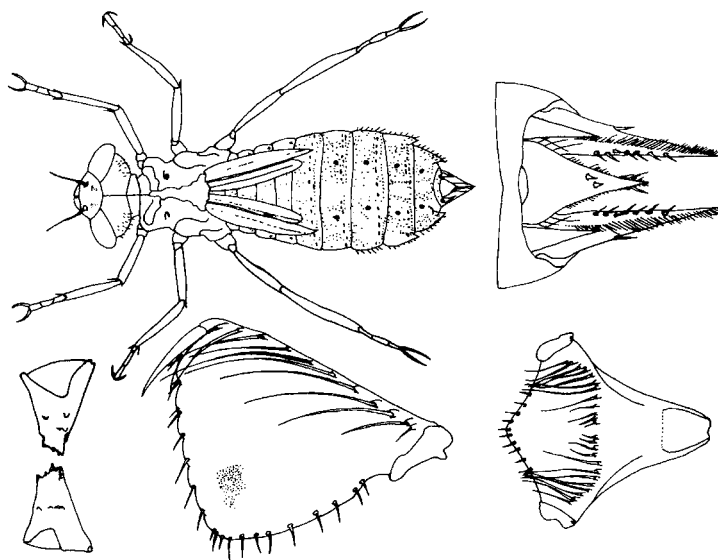


Fig. 3.2.231 *Micrathyria ocellata* larva: habitus from exuvia (upper left), prementum (lower right), mandibles (lower left), right labial palp (lower center), and caudal appendages (upper right). Based on de Assis and Costa (1994).

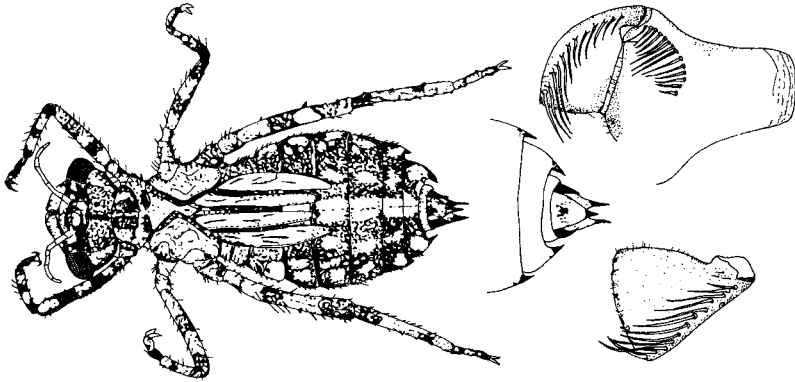


Fig. 3.2.232 *Micrathyria ringueleti* larva: habitus from an exuvia (left), half of the labium (upper right), left labial palp (lower right), and apex of the abdomen in dorsal view (center). Based on Rodrigues Capítulo (1988).

6. The abdomen is about as wide as the head or wider; twice its maximum width is equal to the distance from the thorax between the fore-legs to the end of the caudal appendages. There are numerous small brown spots on the labial palps. The legs usually have dark bands (**Fig. 3.2.228**).7
- The abdomen may be slightly wider or narrower than the head, but twice its maximum width is never greater than the distance from the thorax between the hind legs to the end of the caudal appendages. The legs usually lack conspicuous bands (**Fig. 3.2.233**).9

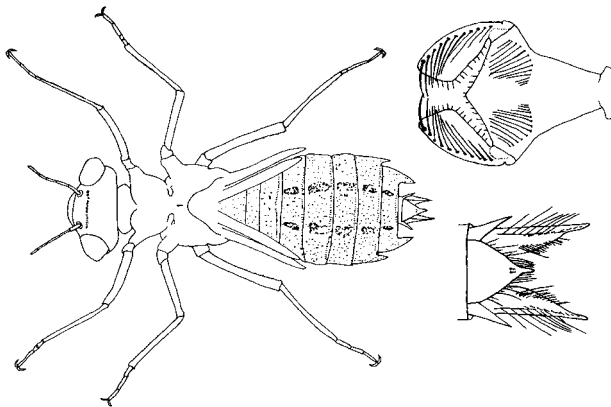


Fig. 3.2.233 *Micrathyria hypodidyma* larva: habitus from exuvia (left), labium in dorsal view (upper right), and caudal appendages in dorsal view (lower right). Based on Santos (1968b).

7. The anterior border of the prementum is concave on each side between a median prominence and lateral prominences bordering the bases of the labial palps, which reach almost as far anteriad as the median prominence. There are about 10 premental setae on each side, 9 long palpal setae, and 1 short palpal seta at the base of the row. Each cercus is about $\frac{2}{3}$ as long as the epiproct. The larva is ochraceous with light and dark markings forming a distinct pattern on the abdomen. The dark bands around the legs include one around each fore-femur and each fore-tibia, two around each middle and hind femur, and usually no conspicuous band around the middle and hind tibia (Fig. 3.2.228). Total length of final instar: c. 15.5 to 16.5 mm.

.....*Micrathyria mengeri* Ris, 1919
(Central America, Trinidad, Colombia, Ecuador, Peru, Venezuela, Guyana, Surinam, French Guiana, Maranhão, Goiás, Espírito Santo, Minas Gerais, Rio de Janeiro). Two subspecies have been described: *Micrathyria mengeri mengeri* Ris, 1919; and *Micrathyria mengeri watsoni* Dunkle, 1995.

- The anterior border of the prementum is straight or convex for most of its length, being concave only near the lateral margin; the median prominence reaches much farther anteriad than the lateral corners of the prementum. There is a row of at least 11 premental setae on each side. The length of each cercus is about $\frac{3}{4}$ the length of the epiproct. The dark bands on the legs usually include two around each of the femora and tibiae (Fig. 3.2.234). 8

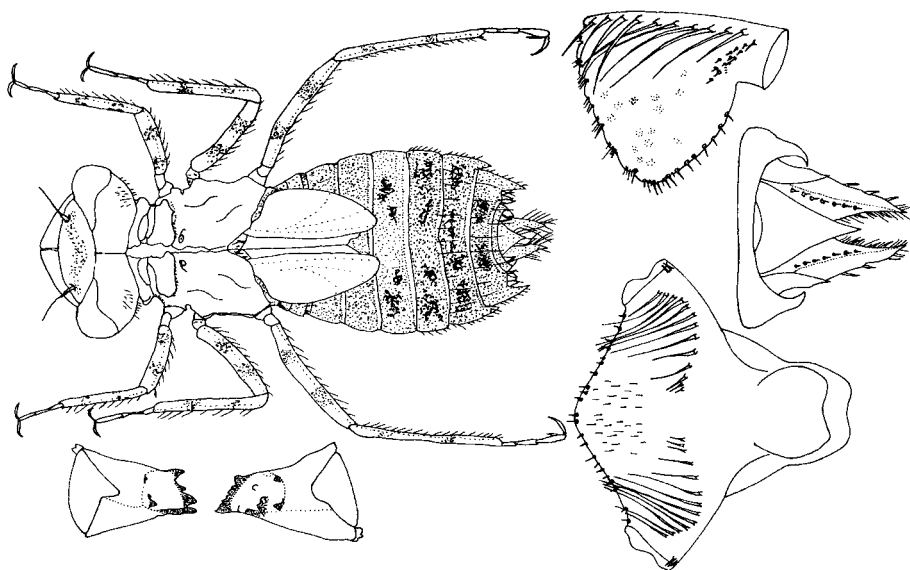


Fig. 3.2.234 *Micrathyria pirassunungae* larva: habitus from an exuvia (upper left), prementum (lower right), mandibles (lower left), right labial palp (upper right), and caudal appendages (middle right). Based on Assis and Costa (1994).

8. The prementum is much wider than long, and it bears a row of 13 setae on each side. There are nine long setae in the row proximal to the movable hook on the labial palp. The abdomen is mainly pale with darker markings (**Fig. 3.2.234**). Total length of final larval instar: c. 16.5 to 17.5 mm.

.....*Micrathyria pirassunungae* Santos, 1953
(Distrito Federal, Goiás, Espírito Santo, Minas Gerais, Rio de Janeiro, São Paulo, Mato Grosso).

- The prementum is much longer than wide, and it bears a row of about 11 setae on each side. There are eight long setae in the row proximal to the movable hook on the labial palp. The abdomen is mainly dark with small pale markings (**Fig. 3.2.117**). Total length of final larval instar: c. 12.5 to 13.5 mm.

.....*Micrathyria hesperis* Ris, 1911
(Venezuela, Argentina, Pará, Piauí, Ceará, Pernambuco, Bahia, Espírito Santo, Minas Gerais, Rio de Janeiro, São Paulo, Paraná, Santa Catarina, Rio Grande do Sul, Goiás, Mato Grosso, Mato Grosso do Sul).

9. The body is uniformly ochraceous without any well-defined light or dark markings on the abdomen. There are small dark spots on the labial palp. The length and width of the prementum are about equal. Each cercus is about 2/3 as long as the epiproct. The setae in the row on each side of the prementum number 12, and there are 9 long setae and one tiny one in the row proximal from the movable hook on the labial palp (**Fig. 3.2.235**). Total length of final larval instar: c. 18.5 to 19.5 mm.

.....*Micrathyria stawiarskii* Santos, 1953
(Federal District, Goiás, Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo, Paraná, Santa Catarina, Rio Grande do Sul).

- The abdomen has distinct light and dark markings (**Fig. 3.2.233**).10

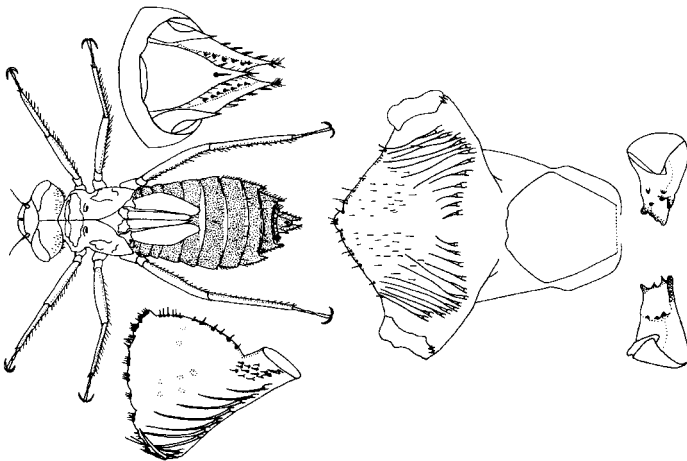


Fig. 3.2.235 *Micrathyria stawiarskii* larva: habitus from exuvia (middle left), prementum (right center), mandibles (right), right labial palp (lower left), and caudal appendages (upper left). Based on de Assis and Costa (1994).

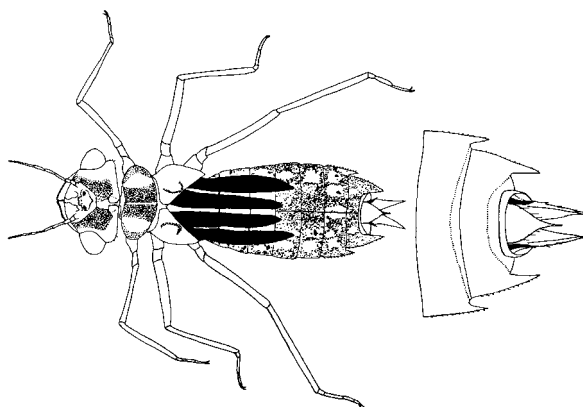


Fig. 3.2.236 *Micrathyria atra* larva: habitus from exuvia (left) and caudal appendages in dorsal view (right). Based on Santos (1978a).

10. The general color is yellow, on which there are pairs of brown dorsolateral markings on the fifth through ninth abdominal segments. Each of the two rows on the prementum includes about 13 setae, and there are about 10 long setae on each row proximal to the movable hook on the labial palp (**Fig. 3.2.233**). Total length of final larval instar: c. 19 mm.

.....*Micrathyria hypodidyma* Calvert, 1906
(Bolivia, Paraguay, Uruguay, Argentina, Rio Grande do Sul, Santa Catarina, Paraná, Rio de Janeiro, São Paulo, Espírito Santo, Minas Gerais, Federal District, Goiás, Bahia). Syn: *Micrathyria protoe* Förster, 1907; *Micrathyria didyma hypodidyma* Calvert, 1906.

- The head and thorax have prominent dark and light markings, and the abdomen is dark with pale spots (**Fig. 3.2.236**).

.....*Micrathyria atra* (Martin, 1897)
(Central America, Trinidad, Ecuador, Peru, Venezuela, Guyana, French Guiana, Surinam, Argentina, Pará, Amazonas, Amapá, Bahia, Pernambuco, Espírito Santo, Rio de Janeiro, Mato Grosso). Syn: *Dythemis atra* Martin, 1897.

Key to the species of adult *Uracis* in South America

Information for the key provided by Costa and Santos (1997). Because most of them are still unknown, a key to the larvae cannot be provided. The dark markings on the wings are variable and cannot be used to recognize a species.

1. In the hind wing, the triangle is free, i.e., not divided by cross veins. In the fore-wing, there are three or four cells in the subtriangle (**Fig. 3.2.237**).2

- In the hind wing, the triangle is crossed. In the fore-wing, there are three to five cells in the subtriangle.4

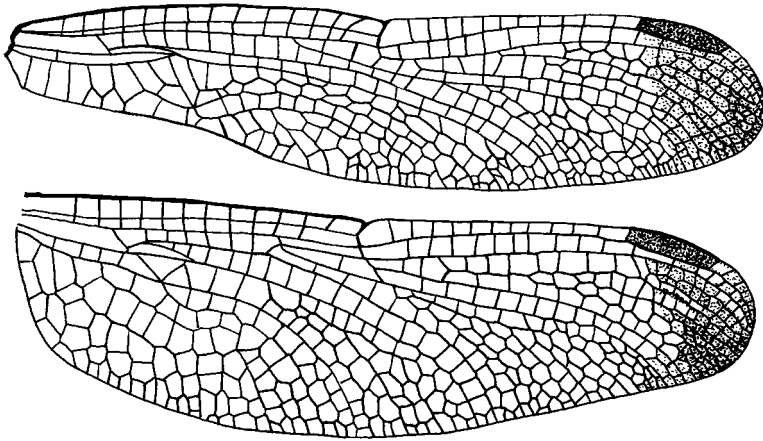


Fig. 3.2.237 Fore and hind wing of *Uracis ovipositrrix*.

2. In both the fore and hind wing, there is only one cubital cross vein. In the fore-wing, the supratriangle is crossed. There are two rows of trigonal cells in the discoidal field of the fore-wing, and they extend beyond the subnodus.*Uracis reducta* Fraser, 1946 (Peru).

- In the fore-wing, there are two to four cubital cross veins. In both the fore and hind wing, the supratriangle is free. There are three cells in the basal part and two rows of cells in the apical part of the discoidal field in the fore-wing, which reach as far as the subnodus (**Fig. 3. 237**).3

3. There are three rows of cells in the anal field. In the hind wing, the discoidal field has one row of cells, which does not reach as far as the fork in M_{1+2} (**Fig. 3.2.237**). Male chromosome number: $2n = 25$, $n = 13$ (Ferreira *et al.*, 1979).

.....*Uracis ovipositrrix* Calvert, 1909 (Ecuador, Peru, Venezuela, Guyana, French Guiana, Surinam, Roraima, Pará, Amazonas, Amapá, Acre, Rondônia, Mato Grosso, São Paulo, Santa Catarina). Syn: *Pronomaja mimetica* Förster, 1909.

- There are two rows of cells in the anal field. In the hind wing, the discoidal field has one row of cells, which reaches or extends beyond the fork in M_{1+2} (**Fig. 3.2.84**).

.....*Uracis siemensi* Kirby, 1897 (Ecuador, Peru, Venezuela, French Guiana, Surinam, Pará, Amazonas, Rondônia, Mato Grosso, Maranhão, Goiás, Minas Gerais, São Paulo).

4. In the fore-wing, the supratriangle is free, and there are one to three cubital cross veins. The apical section of the penis, in lateral view, appears less than

twice as long as wide (**Fig. 3.2.238**). Male chromosome number: $2n = 25$, $n = 13$ (Ferreira *et al.*, 1979).

.....*Uracis imbuta* (Burmeister, 1839)
(Central America, Trinidad, Colombia, Ecuador, Peru, Venezuela, Guyana, French Guiana, Surinam, Bolivia, Argentina, Ceará, Piauí, Bahia, Maranhão, Pernambuco, Alagoas, Roraima, Pará, Amazonas, Amapá, Rondônia, Mato Grosso, Goiás, Paraná). Syn: *Libellula imbuta* Burmeister, 1839; *Uracis quadra* Rambur, 1842.

- In the fore-wing, the supratriangle is crossed, and there are three to seven cubital cross veins. The apical section of the penis, in lateral view, appears more than twice as long as wide (**Fig. 3.2.239**).5

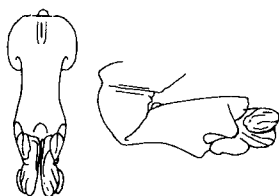


Fig. 3.2.238 Apex of the penis of *Uracis imbuta* in ventral (left) and lateral view (right). Based on Borror (1947).

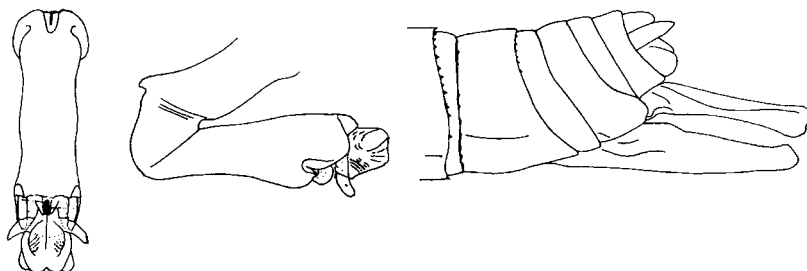


Fig. 3.2.239 *Uracis fastigiata* left to right: penis in ventral and lateral view and the apex of the female abdomen in lateral view. Based on Borror (1947).

5. In the hind wing, there are two rows of cells in the discoidal field, which reach or extend beyond the fork in M_{1+2} . In ventral view, two apical lobes and two finger-like subapical processes are apparent on the penis. The vulvar lamina is long and shaped like a trough (**Fig. 3.2.239**).

.....*Uracis fastigiata* (Burmeister, 1839)
(Mexico, Central America, West Indies, Colombia, Ecuador, Peru, Venezuela, Guyana, French Guiana, Bolivia, Paraíba, Bahia, Maranhão, Tocantins, Roraima, Amazonas, Acre, Rondônia, Mato Grosso). Syn: *Libellula fastigiata* Burmeister, 1839; *Uracis fastigiata* forma *machadina* Förster, 1910; *Uracis fastigiata* aberration *pura* Förster, 1909.

- In the hind wing, there is one row of cells in the discoidal field, which reaches or extends beyond the fork in M_{1+2} (**Fig. 3.2.240**).6

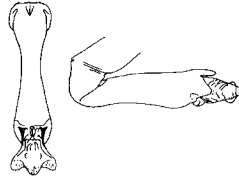


Fig. 3.2.240 Apex of the penis of *Uracis infumata* in ventral (left) and lateral view (right). Based on Borror (1947).

6. In the fore-wing, there are two or three rows of cells in the discoidal field, which reach a point directly posterior to the subnodus or extend beyond it. There is one row of cells in the anal field. The apical section of the penis, in lateral view, appears more than three times as long as wide, and in ventral view, three apical lobes and no finger-like subapical processes are apparent (**Fig. 3.2.240**).

.....*Uracis infumata* (Rambur, 1842)
(Peru, Venezuela, Guyana, French Guiana, Bolivia, Amazonas, Mato Grosso).
Syn: *Libellula infumata* Rambur, 1842; *Uracis ovata* Calvert, 1909.

- In the fore-wing, there are three rows of cells basally and two rows apically in the discoidal field, and they reach only to a point directly posterior to the subnodus. There are two rows of cells in the anal field.

.....*Uracis turrialba* (Ris, 1919)
(Central America).

Key to the species of adult *Misagria* in South America

Information for the key was provided by Geijskes (1951) and DeMarmels (1981a). No larvae of South American species have been described.

1. In the hind wing, the anal loop reaches only as far as the distal end of the triangle and contains 8 to 10 cells. There are five yellow stripes on the synthorax, of which two are confluent. The anterior lamina of the apical margin of the male genitalia on the second segment of the abdomen is bent anteriad, and the hamule is broadly excavated, causing the inner and the triangular outer lobes to be far apart. At the apex, the inferior anal appendage is broad and has two branches that are not bent dorsally (**Fig. 3.2.241**). The color is variable, with males mainly dark brown and black with yellow markings on the middle segments of the abdomen, and females with patterns of yellow, brown and blackish and many yellow or pale brown stripes across the lateral surface of the abdomen. Some younger males display the stripes on the thorax, as well. The

wings of the male are somewhat smoky, and those of the female are usually hyaline. The pterostigma is dark brown to black.

.....*Misagria parana* Kirby, 1889
(Ecuador, Peru, Venezuela, Guyana, French Guiana, Surinam, Amazonas).

- In the hind wing, the anal loop is long, foot-shaped, and has an outer angle extending one to two cells farther than the triangle apex; it has 14 to 16 cells. The anterior lamina of the male genitalia has a furrowed midline, which is excised at the apex. The hamule is large with a quadrangular outer lobe and a hook-like inner lobe separated from the outer lobe by a small excision. The male inferior anal appendage is triangular, acutely angled at the apex, and forked slightly with the apices of the fork curved dorsad (**Fig. 3.2.242**).2

2. The synthorax has yellow lateral spots. The male superior anal appendage is long and slender, and near the apex, it curves dorsad. A triangular process is present on the basal half. The inferior anal appendage is about $\frac{1}{2}$ as long as the superior appendage. The genital lobe of the male is lanceolate (**Fig. 3.2.243**).
.....*Misagria bimacula* Kimmins, 1943

(Venezuela, Guyana).

- There are five large, lateral, yellow stripes on the synthorax, two of which are confluent. The posterior lobe of the male genitalia is broadly rounded (**Fig. 3.2.242**).3

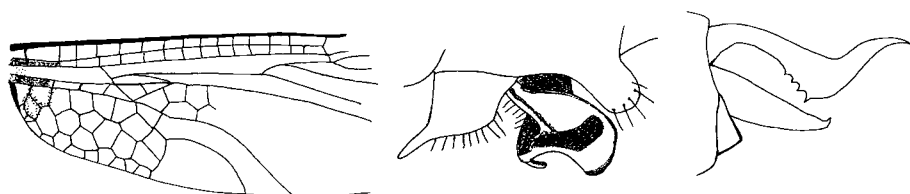


Fig. 3.2.241 *Misagria parana* male: veins at the base of the hind wing (left), genitalia on the second abdominal segment in lateral view (upper right), and the apex of the abdomen in lateral view. Based on Kimmins (1943).

3. The male superior anal appendages curve inward, and the apices converge. There is a triangular process on the ventral side of the apical half of each superior appendage. The inferior anal appendage is about $\frac{3}{4}$ as long as the superior appendage (**Fig. 3.2.242**).

.....*Misagria calverti* Giejskes, 1951
(French Guiana, Surinam).

- The basal parts of the male superior appendages curve inward, and the apical parts are enlarged and diverge sharply. The triangular ventral process is located on the proximal half of the superior appendage. The inferior anal appendage is about half as long as a superior (Fig. 3.2.83). The anal loop of the male consists of 15 or 16 cells, and that of the female, of 17 or 18. Total length: 42 to 45 mm. Length of abdomen without appendages: 29 to 31 mm. Hind wing length: 34 to 36 mm. The pterostigma of the hind wing is 3.9 to 4.1 mm long.

.....*Misagria divergens* DeMarmels, 1981
(Venezuela).

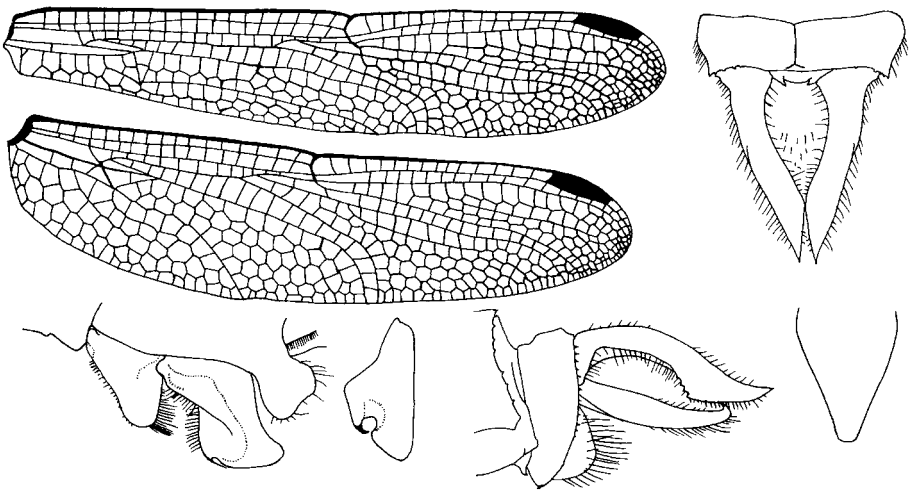


Fig. 3.2.242 *Misagria calverti* male: fore and hind wing (upper left), superior anal appendages in dorsal view (upper right), and (below, left to right): genitalia on the second abdominal segment in lateral view, hamule in ventral view, apex of the abdomen in lateral view, and outline of the inferior anal appendage in ventral view. Based on Geijskes (1951).

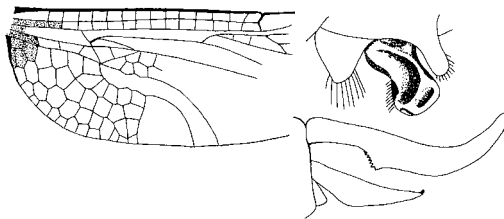


Fig. 3.2.243 *Misagria bimacula* male (left to right): veins at the base of the hind wing, genitalia on the second abdominal segment in lateral view, and apex of the abdomen in lateral view. Based on Kimmins (1943).

Key to the species of male adult *Rhodopygia* in South America

Information for the key was provided by Ris (1911b), Belle (1964a), and Buchholz (1953). Notes on the females are also provided. That all of these species are distinct requires confirmation.

1. The pterostigma is dark reddish brown and 4.25 to 4.5 mm long. The thorax is dull olive green. There is sometimes a small dark brown fleck at the base of the hind wing that extends as far as the end of the membranule and row of cells between Rs and Rspl. The abdomen is dark red. The height of the genital lobe along its anterior margin is distinctly greater than its maximum width (**Fig. 3.2.244**). The vulvar lamina is less than 1/3 as long as the ninth segment of the female. The female is mainly yellowish brown. Length of abdomen: 29 to 37 mm. Hind wing length: 34 to 36 mm.

.....*Rhodopygia hollandi* Calvert, 1911
(Trinidad, Peru, Venezuela, Surinam, Amazonas, Pará, Mato Grosso, São Paulo). Syn: *Rhodopygia chloris* Ris, 1911.

- The length of the pterostigma does not reach 4 mm.2

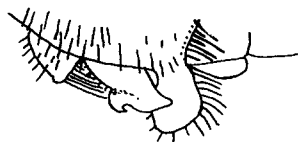


Fig. 3.2.244 *Rhodopygia hollandi*: male genitalia on the second abdominal segment in lateral view. Based on Belle (1964a).

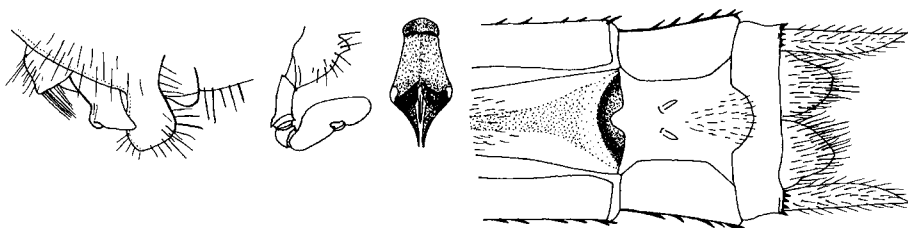


Fig. 3.2.245 *Rhodopygia geijskesi* (left to right): genitalia on the second abdominal segment of the male, penis in right lateral view, ventral view of the seminal vesicle, and the apex of a female abdomen in ventral view. Based on Belle (1964a).

2. The adult male is very dark brown at the base of the hind wing. The dorsal side of the abdomen is rather dark brown. The pterostigma is 3.3 to 4 mm long. There are usually two rows of cells between Rs and Rspl. The hamule and genital lobe are stout (**Fig. 3.2.245**). Total length: 45 to 47 mm; length of abdomen: 28 to 33 mm; of hind wing: 36 to 37 mm.

.....*Rhodopygia geijskesi* Belle, 1964
(French Guiana, Surinam, Venezuela, Brazil).

- At the base of the hind wing, the spot is golden yellow, greenish yellow, or amber rather than dark brown. The mature male usually has a bright red abdomen.3

3. There are usually two rows of cells between Rs and Rspl. The marking at the base of the hind wing of the male is grayish yellow with hyaline areas in the middle of some cells within the marking.

.....*Rhodopygia hinei* Calvert, 1907
(Central America, Ecuador).

- There is usually one row of cells between Rs and Rspl. The marking at the base of the hind wing of the male is brownish to rich golden yellow (**Fig. 3.2.86**).4

4. The synthorax is red. The hind wing is 3.0 times as long as its maximum width. The veins at the base of the hind wing are reddish brown. The hind femur bears two or three long setae followed by a row more than 15 tiny teeth. The hind femur bears six or seven long setae followed by a row of fewer than 10 tiny teeth (**Fig. 3.2.86**). Length of abdomen: 29 to 34 mm. Hind wing length: 37 to 40 mm.

.....*Rhodopygia cardinalis* (Erichson, 1848)
(Peru, Ecuador, Venezuela, Guyana, French Guiana, Surinam, Pará, Amazonas, Mato Grosso, São Paulo). Syn: *Libellula cardinalis* Erichson, 1848; *Rhodopygia cardinalis* var. *colorata* Navás, 1923.

- The synthorax is dark brown. The hind wing is 3.3 times as long as its maximum width. The veins at the base of the hind wing are blackish brown with a bluish pruinosity. The hind femur bears two or three long setae followed by a row of more than 15 tiny teeth (**Fig. 3.2.246**). Hind wing length of male: 37.5 to 38 mm.

.....*Rhodopygia pruinosa* Buchholz, 1953
(Ecuador, Guyana, French Guiana, Bolivia, Pará).

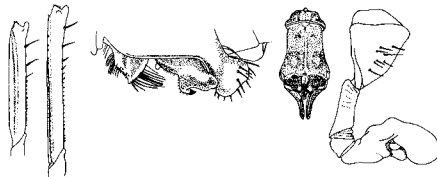


Fig. 3.2.246 *Rhodopygia pruinosa* male (left to right): middle and hind femur, genitalia on the second abdominal segment in lateral view, penis in ventral and lateral view. Based on Buchholz (1953).

Key to the species of known *Rhodopygia* larvae in South America

Information for the key was provided by DeMarmels (1990a), citing an unpublished dissertation by Limongi (1983).

1. The spines on the ninth abdominal segment are each about 2.9 mm long and longer than the combined lengths of the eighth and ninth abdominal segments (**Fig. 3.2.112**). The paraprocts and cerci are divergent apically and curve slightly ventrad. Total length along midline, not considering lateral spines: c. 19.2 mm.

.....*Rhodopygia hollandi* Calvert, 1911
(Trinidad, Peru, Venezuela, Surinam, Mato Grosso, São Paulo).

- The spines on the ninth abdominal segment are each about 2.4mm long and shorter than the combined lengths of the eighth and ninth abdominal segments. The paraprocts and cerci are divergent apically. There are 13 setae in a row on each side of the prementum and 9 or 10 long setae proximal to the movable hook on the labial palp (**Fig. 3.2.247**). Total length including caudal appendages: 17.5 to 19 mm. General color: yellow with blackish pigment, sometimes enough to make the whole larva appear blackish.

.....*Rhodopygia geijskesi* Belle, 1964
(French Guiana, Surinam, Venezuela, Pará). *Rhodopygia chloris* Ris, 1911 seems to be a synonym of this species, since Belle (1964a) was not able to find any definitive differences between these two taxa.

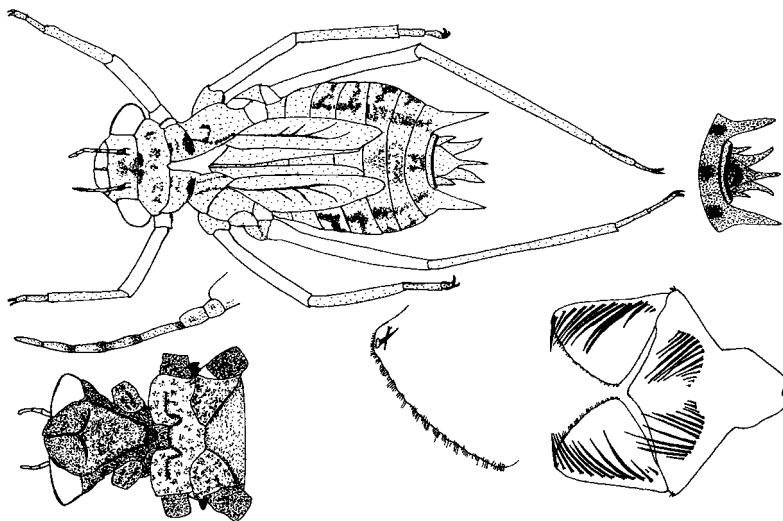


Fig. 3.2.247 *Rhodopygia geijskesi* larva: habitus (upper left), head and thorax in ventral view (lower left), antenna (middle left), apex of the abdomen in dorsal view (upper right), labium (lower right), and the inner edge of the labial palp (lower center). Based on Limongi (1990).

Key to the adult *Erythrodiplax* species in South America

Information for the key provided by Borror (1942, 1957), Santos (1944a, 1946d, 1956), Giejskes (1971), and Machado (1996). The females of all species cannot be identified with certainty, and most larvae remain undescribed, although enough of them are known to prepare a tentative key.

1. There are two cell rows between Rs and Rspl. Cu₁ of the hind wing arises at the anal angle of the triangle. The male usually has a distinct dark subapical band across the wings, which leaves the apical section of the wing hyaline. The vulvar lamina of the female is less than half as long as the ninth segment (**Fig. 3.2.248**).2

- There is usually only one cell row between Rs and Rspl, or, if there are two, then neither sex has a distinct dark band across the wings that leaves the apex hyaline (**Fig. 3.2.249**). In the female, the vulvar lamina is at least as long as the ninth abdominal segment.3

2. There is usually one cell row between M₄ and Mspl. The male and homochromatic female both have dark brown or black bands across each wing between the nodus and stigma. Other specimens lack this band but have darkened apices of the wings. The vulvar lamina of the female is very short, less than ¼ as long as the ninth segment (**Fig. 3.2.250**). Length of abdomen: 22 to 32 mm. Hind wing length: 25 to 34.5 mm. Length of pterostigma: 3.0 to 5.3 mm. The color is highly variable from dark reddish brown with blackish marks to yellow with dark markings on the dorsum of the thorax and on the abdominal segments. Male chromosome number: 2n = 25, n = 13 (Ferreira *et al.*, 1979). Male chromosome number: 2n = 25, n = 12 + X (Mola, 1996).

.....*Erythrodiplax umbrata* (Linnaeus, 1758)
(North America, Central America, West Indies, Colombia, Guyana, French Guiana, Surinam, Venezuela, Peru, Ecuador, Paraguay, Bolivia, Uruguay, Argentina, Amazonas, Rondônia, Espírito Santo, Pará, Mato Grosso, Mato Grosso do Sul, Rio de Janeiro, São Paulo, Rio Grande do Sul). Syn: *Libellula umbrata* Linnaeus, 1758; *Libellula unifasciata* DeGeer, 1773; *Libellula fallax* Burmeister, 1839; *Libellula ruralis* Burmeister, 1839; *Libellula subfasciata* Burmeister, 1839; *Libellula tripartita* Burmeister, 1839; *Libellula flavicans* Rambur, 1842; *Diplax fuscofasciata* Blanchard, 1845; *Trithemis umbrata* (Linnaeus, 1758), *Trithemis montezuma* Calvert, 1899.

- There are usually two cell rows between M₄ and Mspl. The male and homochromatic female have dark brown or black bands from the base or from the triangle to a point midway between the nodus and stigma (**Fig. 3.2.248**). Length of abdomen: 20 to 34 mm. Hind wing length: 25 to 36 mm. Length of pterostigma: 3.4 to 5.5 mm. The color of the body and wing pattern is extremely variable. Males and some females have wings that are black from the base to well distal of the nodus. Other females have wings that are hyaline in the middle and darkened at the base and apex. The bodies of males and

some females are almost entirely black, but some females have yellow markings on the abdomen.

.....*Erythrodiplax funerea* (Hagen, 1861)
(North America, Central America, Colombia, Ecuador). Syn: *Libellula funerea* Hagen, 1861; *Neurothemis affinis* Kirby, 1889; *Belonia funerea* (Hagen, 1861) *Trithemis tyleri* Kirby, 1899.

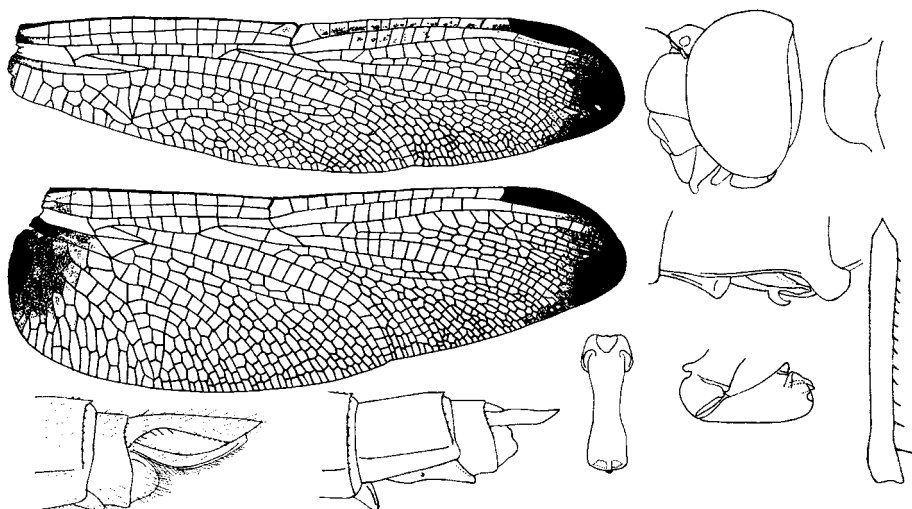


Fig. 3.2.248 *Erythrodiplax funerea*: fore and hind wing of a female (upper left), head in lateral view (above, right of wing), posterior prothoracic lobe (upper right), penis in ventral and lateral view (lower right center, left and right, respectively), male genitalia on the second abdominal segment in lateral view (right of center), apex of the male (lower left) and the female abdomen in lateral view (lower center), and hind femur of a male (lower right). Based on Ris (1919) and Borror (1942).

3. The posterior lobe of the prothorax is small, narrow basally, widened somewhat distally, and truncate, without any trace of an emargination at the midline, and also, the hamule does not appear as wide as the genital lobe in lateral view (**Fig. 3.2.251**). There are seven or eight antenodal cross veins, and the arculus reaches vein Sc between the first and second of these. Total length: 35 to 35.5 mm. Fore-wing length: 28 to 29.5 mm. Hind wing length: 27 to 27.5 mm. The color is mainly yellow with a shiny violet marking on the frons and vertex, black setae, a black ring around each femur and tibia, black tarsi, black lateral carinae on the abdomen, and black on the apical abdominal segments. The wings are hyaline with narrow yellow clouds at the bases.

.....*Erythrodiplax diversa* (Navás, 1916)

(Santa Catarina). Syn: *Nadiplax diversa* Navás, 1916. This species has been avoided in previous revisions because its description leaves out important morphological features. It has therefore not confirmed that the species belongs to *Erythrodiplax*, but if it does, it is not unlikely that its name will turn out to be a senior synonym of a species described later. Any new specimen tentatively identified as this species deserves more thorough study, and such a specimen would greatly assist specialists in better defining this species.

- The posterior lobe of the prothorax is constricted at the base and does not widen distally, or, if not, it has a midline emargination, or the hamule appears as wide as or wider than the genital lobe in lateral view (**Fig. 3.2.252**).4

4. The transverse keel on the second abdominal segment is bent anteriorly to form a right angle. The posterior lobe of the prothorax is narrow basally and distinctly widened distally. The penultimate spine on the outer angle of the hind femur is 3/4 the length of the ultimate spine or longer. The hamule is as wide in profile as the genital lobe (**Fig. 3.2.252**).5

- The transverse keel on the second abdominal segment is curved anteriorly in a gradual curve. The posterior lobe of the prothorax is not widened distally. The penultimate spine on the outer angle of the hind femur is usually half the length of the ultimate spine or shorter. In case of doubt, the hamule in lateral view is more slender than the genital lobe (**Fig. 3.2.253**).7

5. The hind wing is 22 to 31 mm long. The fore-wing usually has 12½ to 14½ antenodal cross veins. The body is entirely reddish brown with a darker dorsum, which is never black. The abdomen is usually somewhat brighter in color. The veins in the basal wing spot are reddish or brownish. The triangle in the hind wing is usually crossed. In lateral view, the apex of the penis is set off by a subapical sulcus (**Fig. 3.2.252**). Length of abdomen: 17.5 to 22 mm.

.....*Erythrodiplax castanea* (Burmeister, 1839)
(Central America, Trinidad, Colombia, Ecuador, Peru, Venezuela, Guyana, French Guiana, Bolivia, Paraguay, Argentina, Amazonas, Rondônia, Pará, Espírito Santo, Santa Catarina, Rio de Janeiro, São Paulo, Mato Grosso). Syn: *Libellula castanea* Burmeister, 1839.

- The hind wing is 20 to 24 mm long. The fore-wing usually has 10½ or 11½ antenodal cross veins. The body is reddish brown or blue-black with a completely black dorsal side of the male thorax. The veins in the basal wing spot are black. Beyond the spot, the wing is hyaline with a dark brown pterostigma. The triangle in the hind wing is usually free (**Fig. 3.2.254**).6

6. The body is reddish brown, except for the black dorsum of the thorax. The basal spot on the hind wing is sometimes weakly developed, and the rest of the wing membrane of the male is usually hyaline (**Fig. 3.2.254**). Length of abdomen: 16 to 18.5 mm. Hind wing length: 20 to 24 mm. Length of pterostigma: 2.0 to 2.3 mm.

.....*Erythrodiplax amazonica* Sjöstedt, 1918
(Trinidad, Guyana, French Guiana, Peru, Venezuela, Amazonas, Pará, Rondônia). Syn: *Erythrodiplax lenti* Ris, 1919.

- The body is entirely black, often with a light bluish sheen. The basal spot on the hind wing is small, and the rest of the wing membrane usually has an amber tinge (**Fig. 3.2.255**). Length of abdomen: c. 18 mm. Hind wing length of male: 22 to 23.5 mm. Length of pterostigma: c. 2.4 mm.

.....*Erythrodiplax melanica* Borror, 1942
(Peru, Pará, Rondônia). Syn: *Erythrodiplax amazonica melanica* Borror, 1942,
Erithrodiplax lenti Ris, 1919.

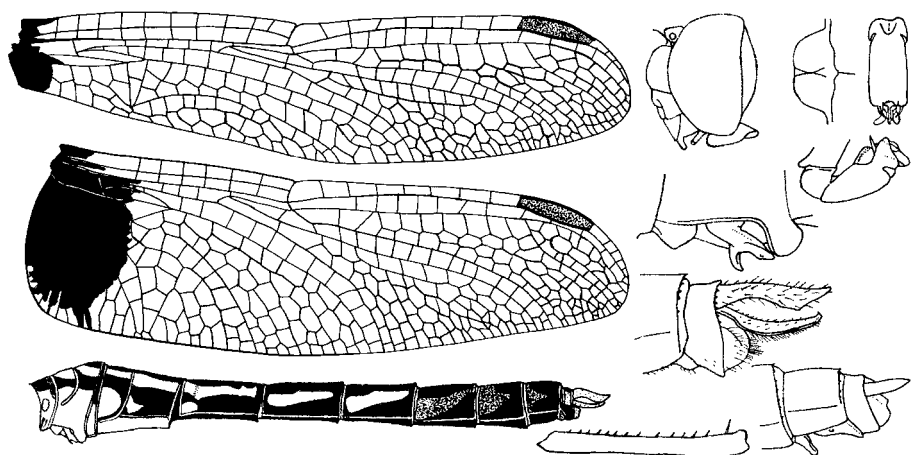


Fig. 3.2.249 *Erythrodiplax lativittata*: fore and hind wing (upper left), head in lateral view (above, right of wing), posterior prothoracic lobe (right of head), penis in ventral and lateral view (upper right, above and below, respectively), male genitalia on the second abdominal segment in lateral view (upper middle right), apex of the abdomen of a male (lower middle right) and a female (lower right) in lateral view, thorax and abdomen in lateral view (lower left), and hind femur of a male (lower right center). Based in part on Borror (1942).

7. The hind wing is 15 to 18 mm long. The base of the hind wing has a large blackish brown spot that reaches the triangle and has a lighter brown or yellow center. In lateral view, a row of about nine small teeth is visible on the ventral side of the superior anal appendage (**Fig. 3.2.253**). The legs and thorax of the male are pruinose bluish gray, and the abdomen is blackish with reddish brown lateral markings and whitish anal appendages. The pterostigma of the male is

cloudy whitish with a darker border and 1.5 to 2.0 mm long. Length of abdomen: 12 to 14 mm. The head of the male is black with whitish markings.

.....*Erythrodiplax maculosa* (Hagen, 1861)
(North America, Venezuela, Guyana, French Guiana, Paraguay, Mato Grosso, São Paulo). Syn: *Nannophya maculosa* Hagen, 1861; *Nannothemis maculosa* (Hagen, 1861) Brauer, 1868; *Diplacodes friedericella* Förster, 1904; *Diplacodella friedericella* (Förster, 1904).

- There is no dark spot with a yellow center at the base of the hind wing, or the hind wing is longer than 18 mm.8

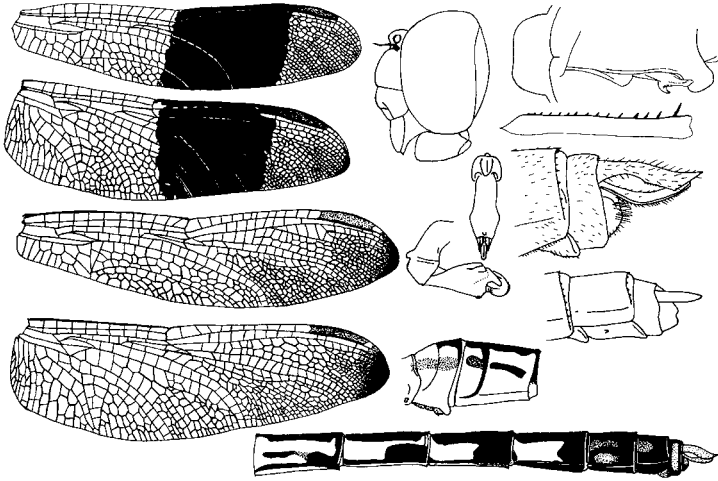


Fig. 3.2.250 *Erythrodiplax umbrata*: fore and hind wing of a male (upper left) and a female (lower left), head in lateral view (upper center), posterior lobe of prothorax (upper right center), and male genitalia on the second abdominal segment in lateral view (upper right), male hind femur (upper middle right), penis in ventral and lateral view (right of center, above and below, respectively), lateral color pattern on the first three and the fourth through tenth abdominal segments of a male (lower right, above and below, respectively), apex of a male (middle right) and a female (lower middle right) abdomen in lateral view. Based in part on Borror (1942).

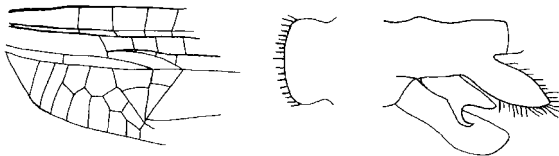


Fig. 3.2.251 *Erythrodiplax diversa* male (left to right): base of the fore-wing, posterior lobe of the prothorax, and hamule and genital lobe in lateral view. Based on Navás (1916).

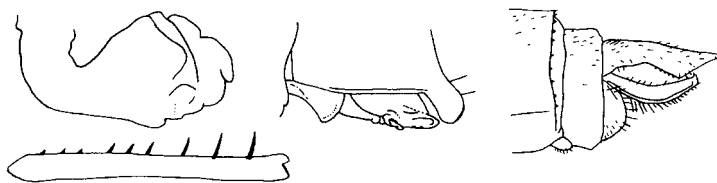


Fig. 3.2.252 *Erythrodiplax castanea* male: apex of penis in lateral view (upper left), hind femur (lower left), genitalia on the second abdominal segment in lateral view (center), apex of abdomen in lateral view. Based on Borror (1942) and Calvert (1948a).



Fig. 3.2.253 *Erythrodiplax maculosa* male (above, left to right): vertex of the head in posterodorsal view, frons extending beyond a compound eye in lateral view, apical part of a claw, lateral view of the genitalia on the second abdominal segment, hamule in anteroventral view, superior anal appendages in dorsal view, and (below, left to right): penis in ventral and lateral view, apex of the abdomen in lateral view, and the inferior anal appendage in ventral view (above lateral view of the anal appendages). Based on Santos (1944a).

8. Males. Accessory genitalia are present on the ventral side of the second and third abdominal segments (**Fig. 3.2.3**).9

- Females. There are no accessory genitalia on the second and third segments of the abdomen. There is a small vulvar lamina on the ventral side of the ninth abdominal segment (**Fig. 3.2.256**).65

9. There is a reddish brown basal spot that extends to the nodus on all wings. The frons is reddish or brownish (**Fig. 3.2.256**). Length of abdomen of male: c. 23 mm. Hind wing length of male: 24 to 26 mm. Length of pterostigma: 2.3 to 3.3 mm.

.....*Erythrodiplax solimaea* (Ris, 1911)
(Amazonas).

- The basal wing spot, if present, usually does not extend distal to the triangle. If the coloration of the wing extends from the base to the nodus or beyond, then the color is brownish black or black, and the frons is metallic blue and yellow (Fig. 3.2.257). 10

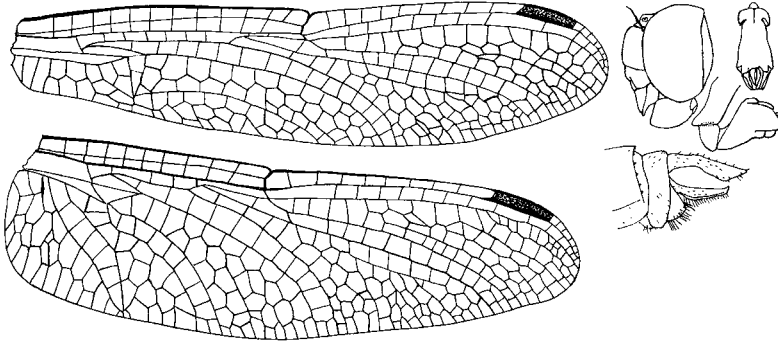


Fig. 3.2.254 *Erythrodiplax amazonica* male: fore and hind wing (left), head in lateral view (upper right center), penis in ventral and lateral view (upper right, above and below, respectively), and apex of the abdomen in lateral view. Based on Borror (1942).

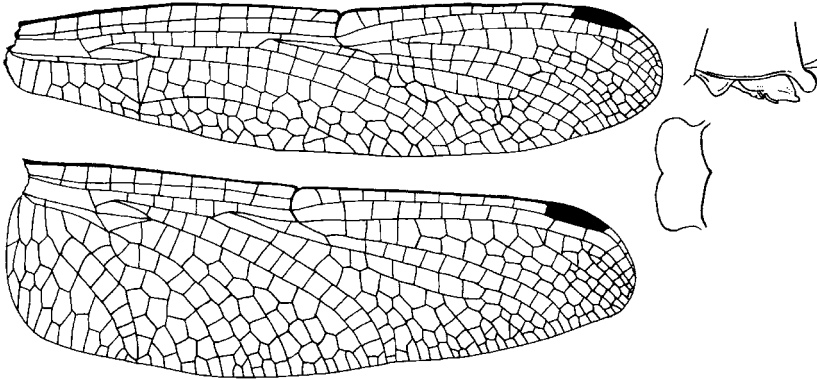


Fig. 3.2.255 *Erythrodiplax melanica* male: fore and hind wing (left) posterior lobe of the pronotum (lower right), and male genitalia on the second abdominal segment (upper right). Based in part on Borror (1942).

10. The genital lobe is truncate with the distal edge straight or nearly so; it is usually nearly upright and not inclined posteriad. The wings are hyaline with a basal spot, which may be small or extend as a basal black area to a point halfway between the nodus and stigma. The penis has paired internal lobes (Fig. 3.2.257). 11

- The genital lobe is rounded, or if the distal edge is straight, then the lobe is strongly inclined posteriad (**Fig. 3.2.258**). The wings usually have only a small basal spot, but their apices may also be brown or black, or there may be a small brown spot distal to the nodus.25

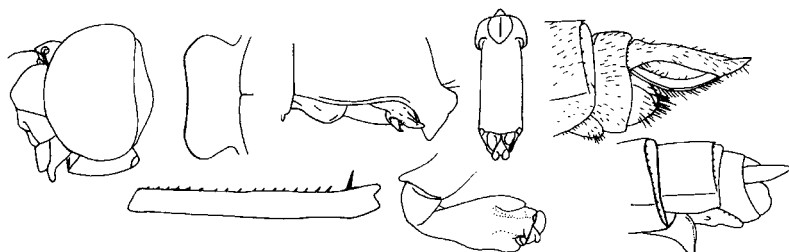


Fig. 3.2.256 *Erythrodiplax solimaea* (above, left to right): head in lateral view, posterior lobe of prothorax, male genitalia on the second abdominal segment in lateral view, penis in ventral view, apex of the male abdomen, and (below, left to right): hind femur of male, penis in lateral view, and apex of female abdomen in lateral view. Based on Borror (1942).

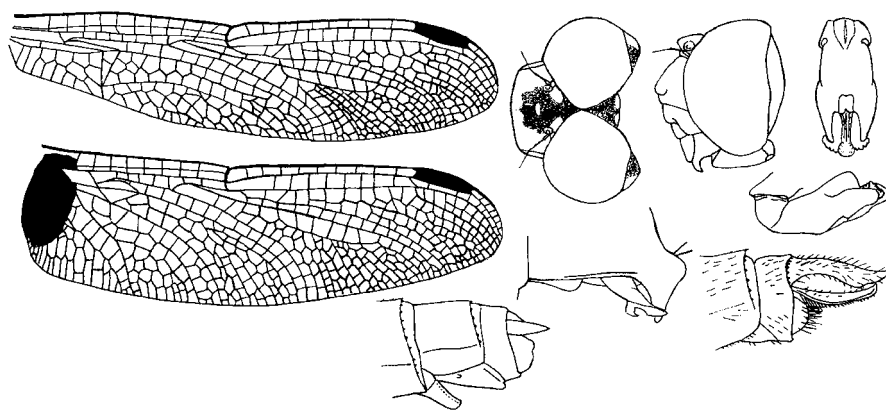


Fig. 3.2.257 *Erythrodiplax kimminsi*: fore and hind wing, head of a male in dorsal (upper center) and lateral view (upper right center), male genitalia on the second abdominal segment in lateral view (lower right center), penis in ventral (upper right) and lateral view (middle right), apex of the abdomen of a male (lower right) and female (lower center) in lateral view. Based on Borror (1942).

11. Cu_1 in the hind wing arises from the anal angle of the triangle, or it is separated from the angle by only a small distance (**Fig. 3.2.257**).12
 - Cu_1 in the hind wing is distinctly separated from the anal angle of the triangle (**Fig. 3.2.259**).21

12. The frons is metallic blue, at least in part (**Fig. 3.2.260**).13
 - The frons is reddish or brownish, without blue markings (**Fig. 3.2.261**).17
 13. The basal spot of the hind wing extends at least to the distal angle of the triangle or slightly beyond, and it covers most of the wing width (**Fig. 3.2.260**).
14

- The basal spot of the hind wing extends no farther than the base of the triangle, and it is usually narrowed posteriorly (**Fig. 3.2.257**).15
 14. There is little or no trace of a basal spot on the fore-wing. The genital lobe is small and somewhat rounded distally (**Fig. 3.2.260**). Hind wing length: 22.5 to 26.0 mm. The male is almost uniformly dark grayish blue, with black only on the head and the spot at the base of the hind wing

.....*Erythrodiplax latimaculata* Ris, 1911 pars
 (Venezuela, Guyana, Argentina, Bolivia, Minas Gerais, Bahia, Rio de Janeiro, São Paulo, Amazonas, Mato Grosso).

- The basal spot in the fore-wing is blackish in the male and extends to the first, second, or third antenodal cross vein. The genital lobe is rather large and widened distally with a nearly straight distal edge. The penis has a bulbous apical lobe (**Fig. 3.2.262**). Length of male abdomen: 19.5 to 23 mm. Hind wing length: 23 to 29 mm. Length of pterostigma: 2.4 to 3.1 mm. The male is mainly black with a dark brown lateral band on the thorax. The wing membrane is usually brown on the apical portion of the wing. Male chromosome number: $2n = 25$, $n = 13$ (Mola, 1996).

.....*Erythrodiplax unimaculata* (De Geer, 1773)
 (Central America, West Indies, Colombia, Ecuador, Peru, Venezuela, Guyana, French Guiana, Surinam, Paraguay, Bolivia, Pernambuco, Bahia, Rio de Janeiro, São Paulo, Pará, Amazonas, Rondônia, Mato Grosso, Mato Grosso do Sul). Syn: *Libellula unimaculata* De Geer, 1773; *Diplax unimaculata* (De Geer, 1773) Hagen, 1861; *Trithemis unimaculata* (De Geer, 1773) Kirby, 1890; *Libellula pulla* Burmeister, 1839; *Micrathyria hemimelaena* Karsch, 1890; *Trithemis erichsoni* Kirby, 1897.

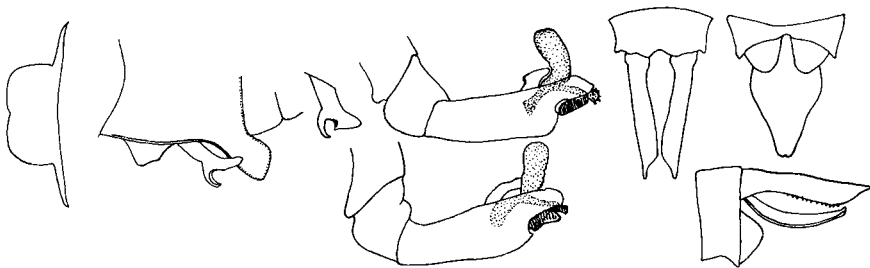


Fig. 3.2.258 *Erythrodiplax luteofrons* male (left to right): prothoracic lobe in anterior view, genitalia on the second abdominal segment in lateral view, penes of two individuals, and the apex of the abdomen in dorsal, ventral, and lateral (below) view. Based on Santos (1956).

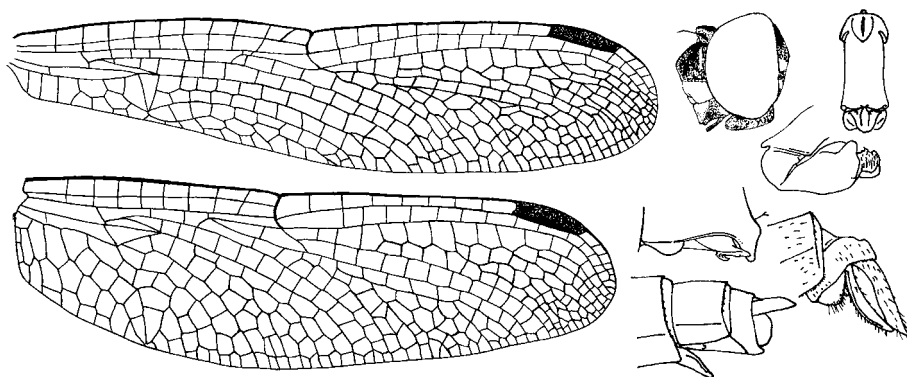


Fig. 3.2.259 *Erythrodiplax anatoidea*: fore and hind wing (left), head in lateral view (upper right center), penis in ventral and lateral view (upper right above and below, respectively), male genitalia on the second abdominal segment in lateral view (below head), apex of the abdomen of a male (lower right) and a female (lower right center) in lateral view. Based in part on Borror (1942).

15. The basal spot on the hind wing of the male is small, extending only as far as the cubital cross vein or the base of A_3 . A lateral keel is distinct only on the apical half of the hamule, which usually slants at an angle of less than 45° . There is no opal band bordering the basal spot on the hind wing. The hind wing has two rows of post-loop cells (**Fig. 3.2.263**). Length of male abdomen: 20.5 to 21.5 mm. Hind wing length: 23.5 to 24 mm. Length of pterostigma: 2.8 to 3.0 mm. Only the male has been described.

.....*Erythrodiplax parvimaculata* Borror, 1942
(Bolivia, Ecuador, Venezuela, Mato Grosso do Sul, São Paulo).

- The basal spot on the hind wing is large, always extending at least to the base of A_3 . A lateral keel is distinct on the apical 2/3 of the hamule, which usually slants at an angle of 60° or more. There is sometimes an opal band bordering the basal spot on the hind wing. The hind wing usually has three or more rows of post-loop cells (**Fig. 3.2.257**).16

16. The basal spot on the hind wing extends to the second or third antenodal cross vein, the triangle, and the anal angle of the wing. The apical portion of the penis appears narrow in lateral view (**Fig. 3.2.264**). Length of male abdomen: 18 to 20.5 mm. Hind wing length of male: 21.5 to 24.5 mm. Length of pterostigma: 2.6 to 2.9 mm.

.....*Erythrodiplax laurentia* Borror, 1942
(Venezuela, Guyana, French Guiana, Surinam, Pará). Syn: *Trithemis erichsoni* Kirby, 1994 (pars).

- The black basal spot on the hind wing extends to the first or second antenodal, the base of A_2 , and the anal angle of the wing, or it may be smaller (**Fig. 3.2.257**). Length of male abdomen: 19.5 to 23.5 mm. Hind wing length of male: 23.5 to 27.7 mm. Length of the pterostigma: 2.6 to 3.1 mm. Except for the metallic blue frons, the head of the male is dark reddish brown. The thorax is also dark reddish brown except for the black dorsal and dull green lateral markings. The abdomen of the male is uniform black.

.....*Erythrodiplax kimminsi* Borror, 1942
(Panama, Colombia, Venezuela, Ecuador, Mato Grosso do Sul). *Trithemis erichsoni* Kirby, 1994 (pars).

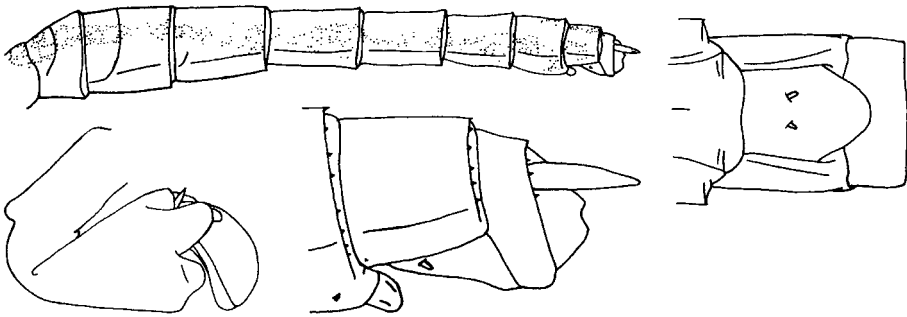


Fig. 3.2.260 *Erythrodiplax latimaculata*: lateral view of the female abdomen showing the color pattern (above left), ventral view of the ninth and tenth segments of the female abdomen (right), lateral view of the apex of the female abdomen (lower center), and the penis in lateral view (lower left). Based on Borror (1957).

17. There is a comma-shaped black mark across the metepisternum below the spiracle. The fore-wing has $7\frac{1}{2}$ or $8\frac{1}{2}$ antenodals. The costa is yellow (**Fig. 3.2.261**). Length of male abdomen: 21 to 25 mm. Hind wing length of male: 24 to 27 mm. The male is uniformly reddish brown with black only on the legs and on the apical segments of the abdomen. The large cloud at the base of the hind wing of the male is reddish brown to orange, while that of the female is smaller and yellowish. The female is yellowish brown with blackish lateral markings on the second through tenth abdominal segments and a black dorsal marking on the eighth and ninth segments. The pterostigma is orange with a narrow blackish border and 2.5 to 3.5 mm long. Male chromosome number: $2n = 25$, $n = 12 + X$ (Mola, 1996).

.....*Erythrodiplax corallina* (Brauer, 1865) pars
(Argentina, Uruguay, Chile).

- There is usually no comma-shaped black mark across the metepisternum below the spiracle. The fore-wing has $7\frac{1}{2}$ to $11\frac{1}{2}$ antenodal cross veins. The costa is usually dark brown (**Fig. 3.2.264**).18

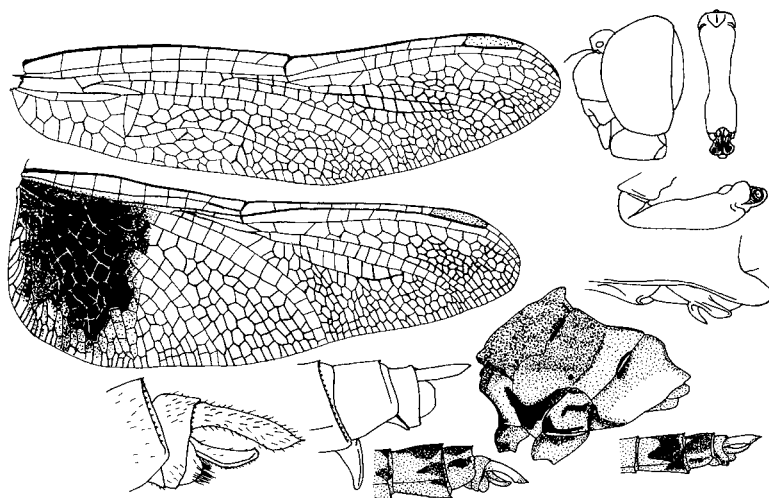


Fig. 3.2.261 *Erythrodiplax corallina*: fore and hind wing of a male (left), head in lateral view (upper right center), penis in ventral and lateral view (upper right, above and below, respectively), male genitalia on the second abdominal segment in lateral view (middle right), male thorax in lateral view (lower right center), apical segments of the male abdomen showing the color patterns of two males (lower center and right), apex of the abdomen of a male (lower left) and a female (lower left center) in lateral view. Based on Borror (1942).

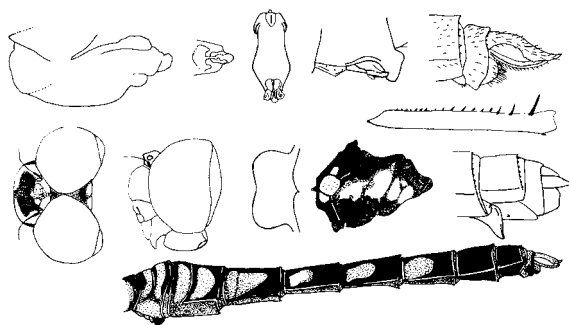


Fig. 3.2.262 *Erythrodiplax unimaculata* (upper row, left to right): apex of the penis of in lateral view, its apex in ventral view, its apical segment in ventral view, male genitalia on the second abdominal segment is lateral view, and apex of the male abdomen in lateral view; the hind femur (upper middle right); and (middle row, left to right): head in dorsal and lateral view, posterior lobe of the prothorax, thorax of a male in lateral view, and apex of the female abdomen in lateral view, and lateral view of the color pattern on the abdomen (below). Based on Borror (1942) and Calvert (1948a).

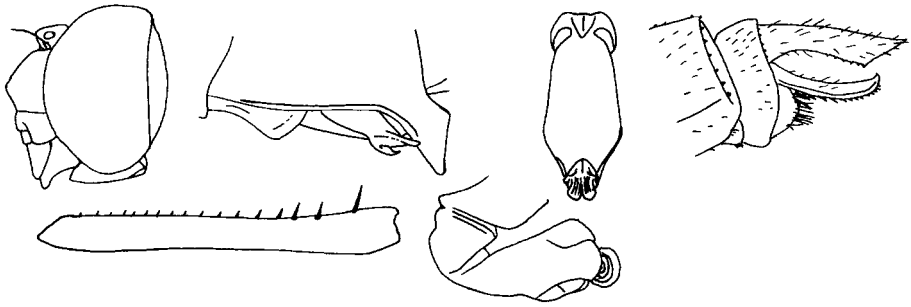


Fig. 3.2.263 *Erythrodiplax parvimaculata* male: head in lateral view (upper left), genitalia on the second abdominal segment in lateral view (upper left center), penis in ventral (upper right center) and lateral view (lower right), hind femur (lower left), and apex of the abdomen in lateral view (upper right). Based on Borror (1942).

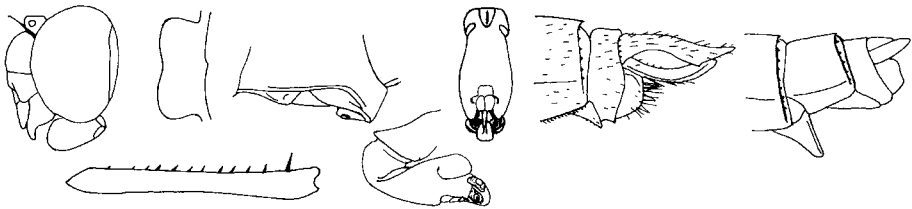


Fig. 3.2.264 *Erythrodiplax laurentia* (above, left to right): head in lateral view, posterior lobe of the prothorax, male genitalia on the second abdominal segment, penis in ventral view, and apex of a male and a female abdomen, and the hind femur (lower left) and penis in lateral view (lower right). Based on Borror (1942).

18. The head of the male is dark brown with a shiny black frons. There are about 18 cells in the anal loop. The male thorax is dark brown with a very broad horizontal olive green lateral stripe. The abdomen of the male is black with pale anal appendages. The fore-wings of the male are black at the bases, while the hind wings are blackened to the triangle (**Fig. 3.2.249**). Otherwise, the wings are hyaline with blackish veins and dark brown pterostigmas. Total length: c. 32 to 34 mm. Length of male abdomen including appendages: c. 21 to 23 mm. Hind wing length of male: c. 27 to 29 mm.

.....*Erythrodiplax lativittata* Borror, 1942
(Venezuela, Colombia, Peru, Argentina, Brazil).

- The head of the male is mainly dark reddish brown, or there are at least 34 cells in the anal loop (**Fig. 3.2.265**).19

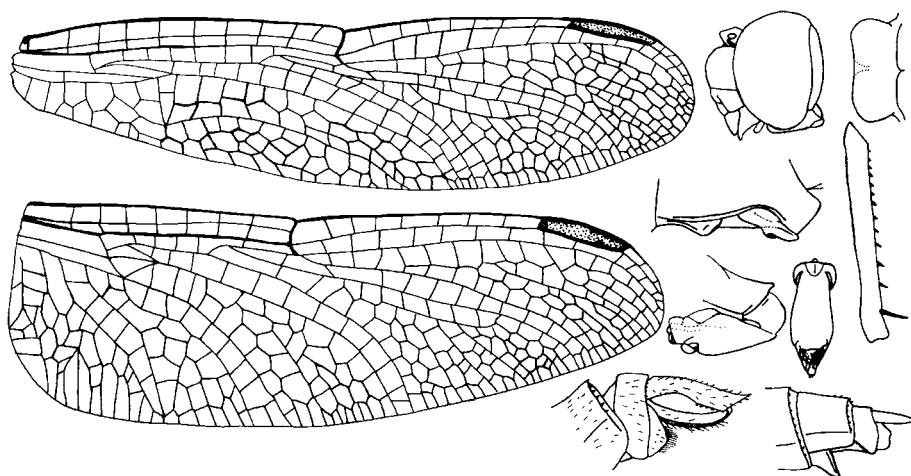


Fig. 3.2.265 *Erythrodiplax ochracea*: fore and hind wing (left), head in lateral view (upper right center), posterior lobe of the prothorax (upper right), male genitalia on the second abdominal segment in lateral view (below head), penis in lateral and ventral view (below genitalia, left and right, respectively), hind femur (middle right), and apex of the abdomen of a male (lower right center) and a female (lower right). Based in part on Borror (1942).

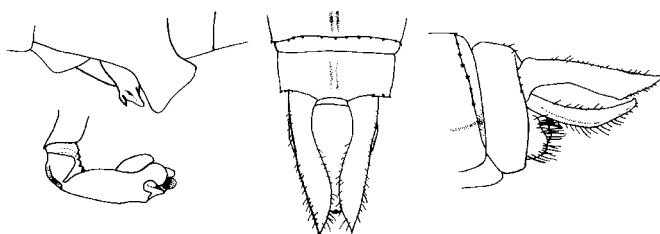


Fig. 3.2.266 *Erythrodiplax leticia* male (left to right): genitalia on the second abdominal segment in lateral view (above) and penis in lateral view (below), apex of the abdomen in dorsal and lateral view. Based on Machado (1996).

19. The inner branch of the hamule is 25% as long as the outer branch or shorter (**Fig. 3.2.265**). Hind wing length: 20 to 22 mm. The head and abdomen of the male are reddish brown, and the thorax is light olive green to yellow. There are about 15 to 18 cells in the anal loop. The abdomen of the female is dull blackish

with yellowish lateral markings. The cloud at the base of the wing is amber. Male chromosome number: $2n = 25$, $n = 12 + X$ (Mola, 1996).

.....*Erythrodiplax ochracea* (Burmeister, 1839) pars (Trinidad, Colombia, Peru, Guyana, French Guiana, Surinam, Argentina, Paraguay, Bolivia, Bahia, Espirito Santo, São Paulo, Rio de Janeiro, Mato Grosso, Mato Grosso do Sul). Syn: *Libellula ochracea* Burmeister, 1839; *Diplax ochracea* (Burmeister, 1939) Hagen, 1861; *Trithemis ochracea* (Burmeister, 1939) Kirby, 1890; *Libellula distinguenda* Rambur, 1942 (pars).

- The inner branch of the hamule is 33% to 50% as long as the outer branch (**Fig. 3.2.266**). The hind wing is at least 22 mm long. The dark marking at the base of the both wings occupies an area extending almost to the arculus or beyond.20

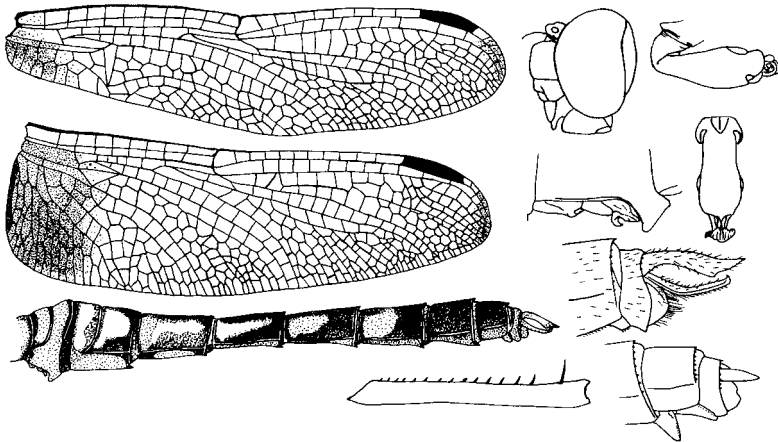


Fig. 3.2.267 *Erythrodiplax fervida*: fore and hind wing (upper left), head in lateral view (upper right center), male genitalia on the second abdominal segment in lateral view (below head), apex of penis in lateral and ventral view (upper right, above and below, respectively), hind femur (lower right center), apex of the abdomen of a male and a female (lower right, above and below, respectively), and lateral view of the thorax and abdomen of a teneral male specimen (lower left). Based in part on Borror (1942).

20. There are 34 to 42 cells in the anal loop. There is a row of seven to nine tiny denticles on the distal half of the superior anal appendage (**Fig. 3.2.266**). The blackish and yellow markings at the base of the wings include one or two rows of cells that have hyaline centers. The pterostigma is brownish yellow. The hind wing length of the male is 26 to 30.5 mm. Pterostigma length: 3.1 to 3.7 mm. The female has not been described.

.....*Erythrodiplax leticia* Machado, 1996 (Bahia, Paraíba).

- There are 18 to 27 cells in the anal loop (**Fig. 3.2.267**). There is a row of tiny denticles on the distal 2/3 of the superior anal appendage. Hind wing length: 22 to 28 mm. The dark markings at the bases of the both wings occupy an area extending almost to the arculus or beyond. The rest of the wing is hyaline with a blackish pterostigma, 2.4 to 3.7 mm long. The head and thorax of the male are largely reddish brown, slightly lighter on the ventral part of the thorax. The abdomen of the male is 19 to 24 mm long and red with black markings becoming larger toward the apex; the ninth segment is almost entirely black.

.....*Erythrodiplax fervida* (Erichson, 1838)
(Mexico, Central America, West Indies, Colombia, Venezuela, Guyana, French Guiana, Surinam). Syn: *Libellula fervida* Erichson, 1838; *Libellula justina* Selys in Sagra, 1857; *Libellula distinguenda* Rambur, 1942 (pars).

21. There are usually three rows of post-loop cells in the hind wing. The wing color is highly variable. The frons is metallic blue and yellow (**Fig. 3.2.268**). The general coloration is dark brown to blackish, and the markings are mainly yellow.22

- There are always one or two rows of post-anal loop cells in the hind wing. The wings are mainly hyaline or with a uniform brownish tinge and only a basal spot (**Fig. 3.2.259**). 23

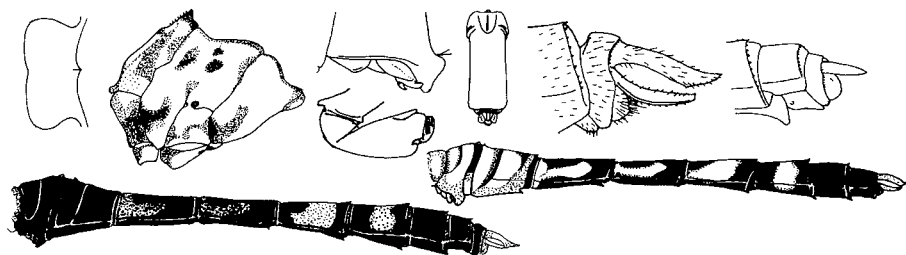


Fig. 3.2.268 *Erythrodiplax attenuata* (above, left to right): posterior lobe of the prothorax, thorax of a male in lateral view, lateral views of the genitalia on the second abdominal segment (above) and penis (below), ventral view of apical segment of the penis, apex of the abdomen of a male and a female, and the color pattern on the lateral surfaces of the thorax and abdomen of a fully mature adult male (lower left) and a teneral male (lower right). Based on Borror (1942).

22. The yellow spot on the side of the sixth abdominal segment extends to the dorsal carina and caudad beyond the middle of the segment (**Fig. 3.2.268**). Hind wing length: 20 to 26 mm. Some specimens have hyaline wings, while others

have large colored areas covering the middle of the wing. The yellowish lateral markings on the abdomen are sometimes obscure. Length of male abdomen: 18 to 22.5 mm. Hind wing length of male: 20 to 26 mm. Length of pterostigma: 1.9 to 3.0 mm. Male chromosome number: $2n = 25$, $n = 13$ (Ferreira *et al.*, 1979).

.....*Erythrodiplax attenuata* (Kirby, 1894)
(Colombia, Ecuador, Peru, Venezuela, Surinam, Bolivia, Pará, Amazonas, Rondônia, Mato Grosso, São Paulo). Syn: *Trithemis attenuata* Kirby, 1894; *Erythrodiplax attenuata* forma *hyalina* Sjöstedt, 1918.

- The yellow spot on the side of the sixth abdominal segment does not extend to the dorsal carina and usually does not reach the middle of the segment (**Fig. 3.2.269**). Hind wing length: 23 to 28 mm. Immature males are mainly bright yellow and blackish. The wings are sometimes marked with a dark cloud crossing the middle of the wing. The pterostigma is usually dark brown and 2.8 to 3.0 mm long. Length of male abdomen: 20.5 to 23 mm.

.....*Erythrodiplax venusta* (Kirby, 1897)
(Peru, Venezuela, Guyana, Surinam, Bolivia, Amazonas, Mato Grosso). Syn: *Micrathyria venusta* Kirby, 1897; probably *Libellula erratica* Erichson, 1848.

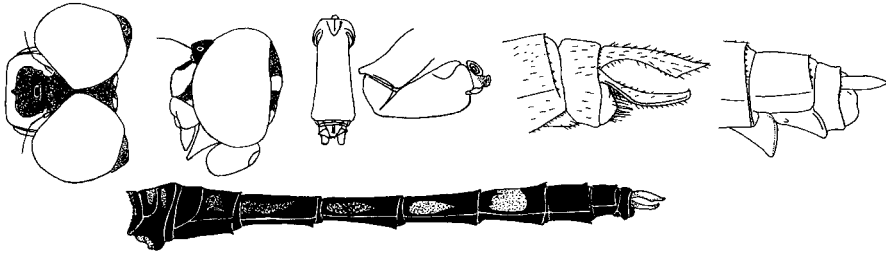


Fig. 3.2.269 *Erythrodiplax venusta* (above, left to right): head in dorsal and lateral view, apex of the penis in ventral and lateral view, and apex of the abdomen of a male and a female, and (below) thorax and abdomen of a nearly mature male in lateral view. Based on Borror (1942).

23. In lateral view, the hamule appears to project from the outer branch at a right or obtuse angle and be at least $2/3$ as long as the outer branch. In lateral view, the penis appears broadly truncate at the apex (**Fig. 3.2.270**). Length of male abdomen: 22 to 24 mm. Hind wing length of male: 18 to 25 mm. Length of pterostigma: 2.3 to 2.9 mm.

.....*Erythrodiplax angustipennis* Borror, 1942
(Peru, Venezuela, Surinam, French Guiana, Bolivia, Mato Grosso).

- In lateral view, the hamule appears to project from the outer branch at less than a right angle and be no more than $1/3$ as long as the outer branch (**Fig. 3.2.259**).24

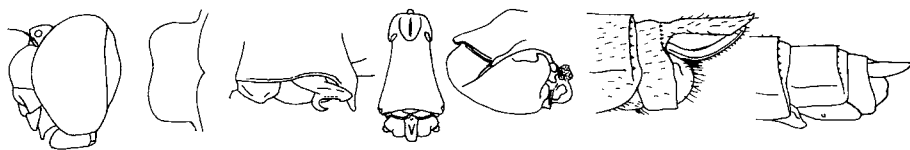


Fig. 3.2.270 *Erythrodiplax angustipennis* (left to right): head in lateral view, posterior lobe of the prothorax, male genitalia on the second abdominal segment in lateral view, apex of the penis in ventral and lateral view, and apex of the abdomen of a male and a female. Based on Borror (1942).

24. The frons is whitish, yellowish, or brownish. There is usually one row of post-loop cells for a short distance in the hind wing (**Fig. 3.2.271**). Length of male abdomen: 18 to 19.5 mm. Hind wing length: 20 to 21.5 mm. Length of pterostigma: 2.0 to 2.4 mm.

.....*Erythrodiplax longitudinalis* (Ris, 1919)
(Venezuela, French Guiana, Surinam, Amazonas, Mato Grosso do Sul). Syn: *Anatya longitudinalis* Ris, 1919.

- The frons is metallic bluish black. There are two rows of post-anal loop cells in the hind wing (**Fig. 3.2.259**). Length of male abdomen: c. 22 mm. Hind wing length: 19 to 21.5 mm. Length of pterostigma: 2.2 to 2.6 mm. The male is usually considerably darker and becomes bluish gray with age. The legs are yellow to the bases of the femora, and the rest of the femora, tibiae, and tarsi are black. Beyond the clouded bases of the wings, they are hyaline with blackish or grayish pterostigmas.

.....*Erythrodiplax anatoidea* Borror, 1942
(Rondônia).

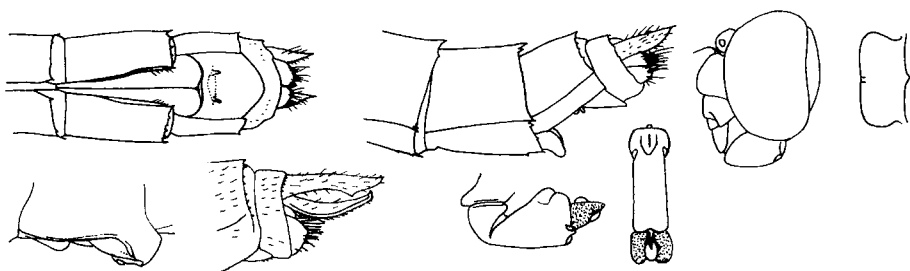


Fig. 3.2.271 *Erythrodiplax longitudinalis* (above, left to right): apex of the abdomen of a female in ventral and lateral view, head and posterior lobe of the prothorax of a male, and (below, left to right): male genitalia on the second abdominal segment in lateral view, apex of the male abdomen, and apex of the penis in lateral and ventral view. Based on Borror (1942) and Geijskes (1971).

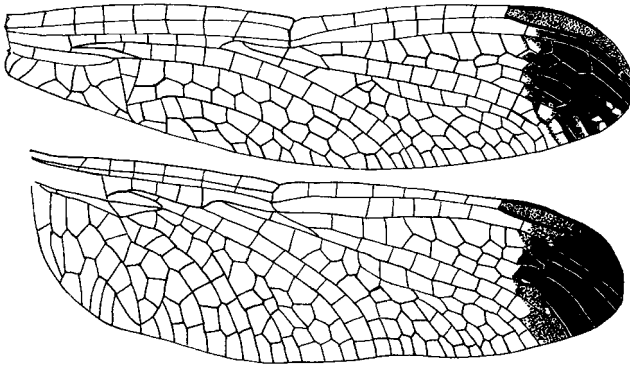


Fig. 3.2.272 Fore and hind wing of *Erythrodiplax lygaea*.

25. The entire face is light yellow with a greenish tinge laterally on the frons and on the postclypeus. The labrum is yellowish, and the labium is ochraceous with a brown central portion of variable size. The vertex is shiny metallic blue with a yellow base; the occiput is black. The thorax, legs, abdomen, and anal appendages of mature adults are uniformly dark brown or almost black, except for a whitish inner surface of the anterior femora. Immature specimens have light olive lateral surfaces on the thorax and a brown antehumeral surface. There are also greenish yellow lateral stripes on the fifth through ninth abdominal segments. The wings are hyaline or lightly clouded with brown and have golden yellow markings at the bases of the wings. The pterostigma is ochraceous. The penis lacks internal lobes but has large posterior and median lobes (**Fig. 3.2.258**). Length of male abdomen without anal appendages: c. 18 mm. Length of superior anal appendage of male: c. 1.2 mm; inferior appendage: c. 0.9 mm. Hind wing length of male: c. 23 mm. Length of pterostigma of fore-wing: c. 2.9 mm. The female has not been described.

.....*Erythrodiplax luteofrons* Santos, 1956
(São Paulo, Minas Gerais).

- The face is not entirely light yellow, or if it is largely yellow, then the penis has large posterior lobes covered with long hairs and a large, heavily sclerotized basal portion (**Fig. 3.2.261**).26

26. Vein Cu₁ in the hind wing arises from or very near the anal angle of the triangle (**Fig. 3.2.261**).27

- Vein Cu₁ in the hind wing arises some distance from the anal angle of the triangle (**Fig. 3.2.272**).49

27. There is a comma-shaped black mark across the metepisternum below the spiracle. The fore-wing has 7½ or 8½ antenodals. The costa is yellow. The basal spot on the hind wing is yellowish brown or dark red and extends at least to the

second antenodal cross vein, the middle of the triangle, and the anal angle (**Fig. 3.2.261**). Hind wing length: 24 to 27.5 mm.

.....*Erythrodiplax corallina* (Brauer, 1865) pars (Argentina, Uruguay, Chile). See couplet 17.

- There is usually no comma-shaped black mark across the metepisternum below the spiracle. The fore-wing has $7\frac{1}{2}$ to $12\frac{1}{2}$ antenodal cross veins (**Fig. 3.2.273**).28

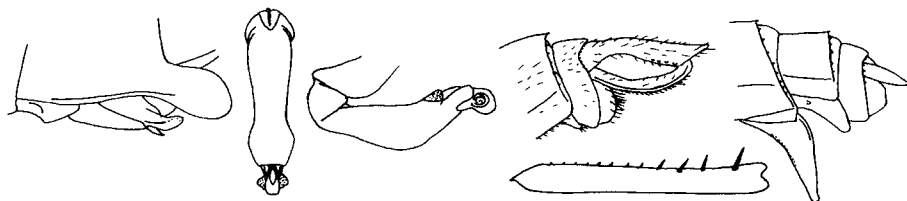


Fig. 3.2.273 *Erythrodiplax naeva* (left to right): male genitalia on the second abdominal segment in lateral view, apex of the penis in ventral and lateral view, apex of the male and female abdomen (above), and femur (below). Based on Borror (1942).

28. The genital lobe is small, generally rounded distally, and not conspicuously overlying posteriorly. The penis has paired internal lobes and lacks a posterior lobe (**Fig. 3.2.273**).29

- The genital lobes are usually conspicuously overlying posteriorly. The penis lacks paired internal lobes and sometimes has a posterior lobe (**Fig. 3.2.274**).32

29. The hind wing lacks a distinct basal black spot but may have a trace of brownish color at the base. The posterior lobe of the prothorax is constricted at the base. The stigma of the fore-wing is usually less than 3 mm in length. There is only one row of cells between R_s and M_2 . There are usually 4 to 7 marginal cells in the discoidal field of the fore-wing. The tip of the outer branch of the hamule is straight or slightly curved caudad. The terminal segment of the penis is distinctly widened ventrad in the middle or at $3/5$ of its length, in lateral view (**Fig. 3.2.273**). Length of male abdomen: 21 to 25 mm. Hind wing length: 23 to 27 mm. Length of pterostigma: 2.3 to 3.0 mm.

.....*Erythrodiplax naeva* (Hagen, 1861) pars (North and Central America, West Indies, Colombia, Venezuela). Syn: *Dythemis naeva* Hagen, 1861. *Erythrodiplax naeva* (Hagen, 1861) has been treated as a subspecies of the North American species, *Erythrodiplax berenice* (Drury, 1773), from which it is distinguished by its 4 to 7 marginal cells in the discoidal field, its pterostigma shorter than 3 mm, and its range, which encompasses Central and South America and some of the West Indies. *Erythrodiplax berenice*

has a pterostigma on the fore-wing 3 mm or more in length and 6 to 10 marginal cells in the discoidal field. Synonyms of one or both subspecies include *Libellula berenice* Drury, 1773; *Diplax berenice* (Drury, 1773); *Libellula histrio* Burmeister, 1839. In this key, *Erythrodiplax naeva* is treated as a distinct species, but some specimens of *E. berenice* will also key out here. Dunson (1980) referred to *E. berenice* as a marine dragonfly, which tolerates the full salinity of seawater.

- The hind wing always has a distinct basal black spot. The posterior lobe of the prothorax is not constricted at the base (**Fig. 3.2.275**). 30

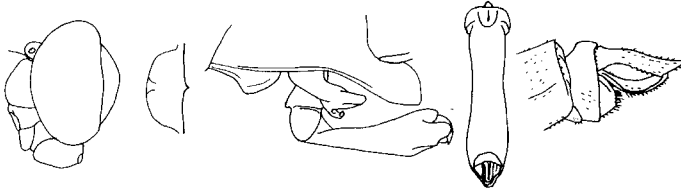


Fig. 3.2.274 *Erythrodiplax acantha* male (left to right): head in lateral view, posterior lobe of the prothorax, lateral view of the genitalia on the second abdominal segment with penis extended, apical penis segment in ventral view, and apex of the abdomen in lateral view. Based on Borror (1942).

30. The black basal spot on the hind wing extends to the fourth or fifth antenodal cross vein and the distal angle of the triangle. The fore-wing is hyaline or it has a black spot that reaches the first antenodal cross vein. The posterior lobe of the prothorax is squarish and not narrowed distally. The apical segment of the penis widens at the apex to about double its basal width, and its median lobes are much larger than the lateral ones (**Fig. 3.2.260**). Hind wing length: 22.5 to 26 mm.

.....*Erythrodiplax latimaculata* (Ris, 1911) pars (Venezuela, Guyana, Argentina, Bolivia, Minas Gerais, Bahia, Rio de Janeiro, São Paulo, Amazonas, Mato Grosso). See couplet 14.

- The fore and hind wings have variable basal spots that extend nearly equally far distad. In lateral view, the apical segment of the penis widens at the apex to less than double its basal width (**Fig. 3.2.275**).31

31. The frons of the adult is orange red, and the wing spot is reddish brown. The median lobes of the penis are much larger than the lateral lobes (**Fig. 3.2.275**). Hind wing length: no more than 22 mm. The thorax of the male is bright yellow, slightly darker dorsally. The abdomen is dirty yellow with dark dorsal and lateral markings. The large basal area is amber with white veins. Beyond that area, the wings are hyaline with brown or blackish veins and blackish pterostigmas.

.....*Erythrodiplax fulva* Borror, 1957 (French Guiana, Venezuela).

- Frons and wing spots of adults brown or black. The median lobes of the penis are not larger than the lateral lobes (**Fig. 3.2.276**). Hind wing length: at least 22 mm. The upper part of the thorax is tan, and the lower part is yellow, with a clear border between them. The basal segments of the abdomen are yellowish brown, and the rest are mainly dark brown. The wings are sometimes slightly darkened at the apex as well as at the base.

.....*Erythrodiplax famula* (Erichson, 1848)
(Central America, West Indies, Peru, Venezuela, Surinam, Guyana, French Guiana, Surinam, Argentina, Pará, Minas Gerais, São Paulo).

32. The median process of the penis is small, and a posterior lobe is lacking (**Fig. 3.2.88**). The male is dark brown and black with clear wings. The pterostigma is brown. Hind wing length: 21.5 to 22.0 mm long.

.....*Erythrodiplax transversa* Borror, 1957
(Venezuela, Guyana).

- If the specimen is predominantly blackish, then the median process of the penis is well developed, or a posterior lobe is present (**Fig. 3.2.274**).33

33. The median process of the penis terminates in a single heavily chitinized spine pointed directly ventrad. The wings are hyaline except for a small brownish spot at the base of the hind wing that extends no farther than the cubital cross vein and apex of the membranule (**Fig. 3.2.274**). Hind wing length: 23 to 24.5 mm.

.....*Erythrodiplax acantha* Borror, 1942
(São Paulo).

- The median process of the penis does not terminate in a single heavily chitinized spine (**Fig. 3.2.277**).34

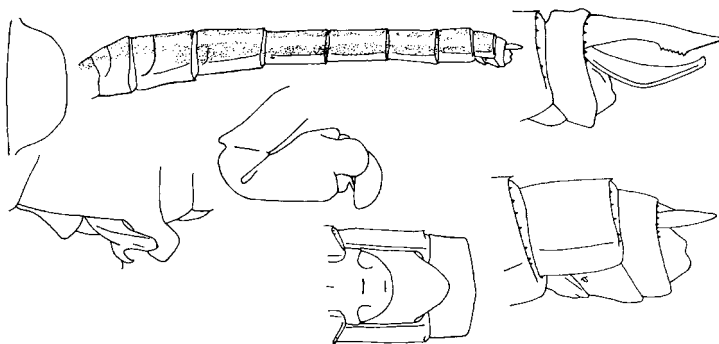


Fig. 3.2.275 *Erythrodiplax fulva*: posterior lobe of the female prothorax (upper left), lateral view of the female abdomen showing the color pattern (upper center), ventral view of the ninth and tenth segments of the female abdomen (lower right center), lateral view of the apex of the male (upper right) and female abdomen (lower right), lateral view of the male genitalia on the second abdominal segment (lower left), and the penis in lateral view (center). Based on Borror (1957).

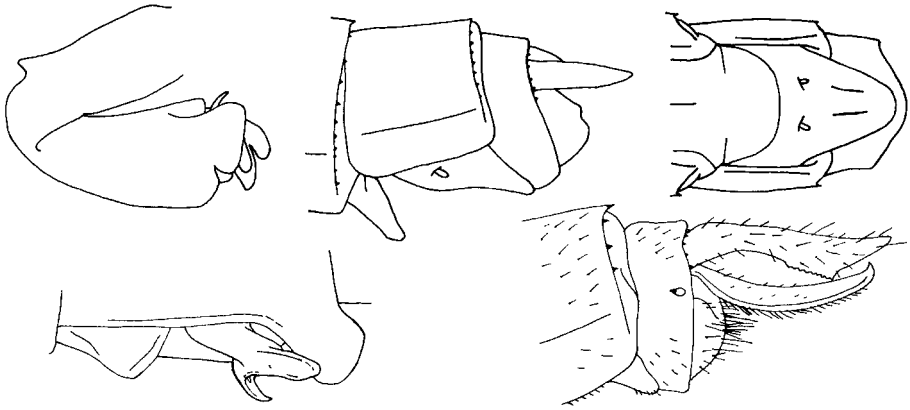


Fig. 3.2.276 *Erythrodiplax famula* (above, left to right): penis in lateral view, apex of the abdomen of a female, and ventral view of the ninth and tenth segments of a female, and the male genitalia on the second abdominal segment in lateral view (lower left), and the apex of the male abdomen in lateral view (lower right). Based on Borror (1942, 1957).

34. The median process of the penis is bilobed with the lobes extending ventrad (**Fig. 3.2.277**). The somewhat flattened frons is metallic bluish black with a violet luster. Hind wing length: 20 to 26 mm. Most of the body of the male is a uniform dark blue. The anal appendages are light brown.

.....*Erythrodiplax juliana* (Ris, 1911) pars
(Colombia, Peru, Venezuela, Bolivia, Amazonas, Minas Gerais, Espirito Santo, São Paulo).

- The median process of the penis is not bilobed (**Fig. 3.2.278**).35
35. The penultimate spine at the outer angle of the hind femur is $\frac{1}{3}$ the length of the last spine or less. The median process extends slightly or not at all beyond the apex of the median lobes and lacks a tuft of bristles at its tip. There is a well-developed posterior lobe on the penis, which can form a sac or mitten-like structure extending dorsad from the apex of the penis or can be withdrawn back into the penis so that it is not apparent. The frons varies in shape, is bluish black in fully developed adults, and sometimes has a pair of yellow spots below the antennal bases just beside the compound eyes. The inner branch of the hamule is bent rather abruptly caudad often obscuring the inner branch, when viewed in lateral view. Hind wing length: 19 to 25 mm. The thorax of the male is dark brown, and the abdomen is blackish with obscure reddish brown lateral markings, usually most prominent on the sixth and seventh abdominal segments. The wings are hyaline with brown veins or there is an amber subapical cloud.

The pterostigma is yellowish with darker anterior and posterior margins (**Fig. 3.2.278**). Male chromosome number: $2n = 25$, $n = 12 + X$ (Mola, 1996).

.....*Erythrodiplax nigricans* (Rambur 1842)
(Argentina, Uruguay, Paraguay, Rio Grande do Sul, Rio de Janeiro, Minas Gerais). Syn: *Libellula vilis* Rambur, 1842; *Erythrodiplax chloropleura* (Brauer) Ris, 1904.

- The penultimate spine at the outer angle of the hind femur is at least half the length of the last spine, and/or the median process of the penis extends well beyond the apex of the median lobes (**Fig. 3.2.279**).36

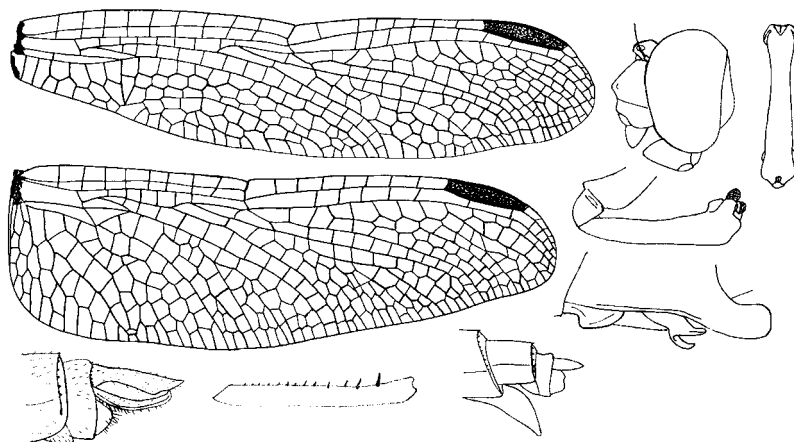


Fig. 3.2.277 *Erythrodiplax juliana*: fore and hind wing (upper left), head in lateral view (upper right center), penis in ventral (upper right) and lateral view (middle right), male genitalia on the second abdominal segment in lateral view (lower right), hind femur (lower left center), apex of a male (lower left) and female abdomen (lower right center) in lateral view. Based in part on Borror (1942).

36. There is a well-developed posterior lobe on the penis, which can form a sack or mitten-like structure extending dorsad from the apex of the penis or can be withdrawn back into the penis so that it is not apparent. The median process extends beyond the apex of the median lobes to a distance about equal to the lobes themselves and lacks a tuft of bristles at its tip. The frons varies in shape, is bluish black in fully developed adults, and sometimes has a pair of yellow spots below the antennal bases just beside the compound eyes. The inner branch of the hamule is usually apparent in lateral view (**Fig. 3.2.279**).37

- The posterior lobe of the penis is poorly developed or lacking. The median process of the penis extends beyond the apex of the median lobes by a distance equal or greater than the length of the lateral lobes. The apex of the median process is rounded, concealing a tuft of bristles when not erect but appearing

foot-slaped with the bristles exposed in lateral view. The inner branch of the hamule is usually visible in lateral view (**Fig. 3.2.280**).41
 37. The terminal segment of the penis is 1.85 to 2.05 mm from the anterior meatus to the apex of the lateral lobe. The pterostigma of the fore-wing is 3.1 to 4.1 mm (**Fig. 3.2.279**). Hind wing length: 23 to 27.5 mm.

.....*Erythrodiplax hyalina* Förster, 1907 pars
 (Paraguay, Uruguay, São Paulo, Santa Catarina, Rio Grande do Sul).

- The terminal segment of the penis is 1.8 mm or less from the anterior meatus to the apex of the lateral lobe. The pterostigma of the fore-wing is 1.8 to 4.0 mm (**Fig. 3.2.281**). Hind wing length: 16.5 to 27 mm.38

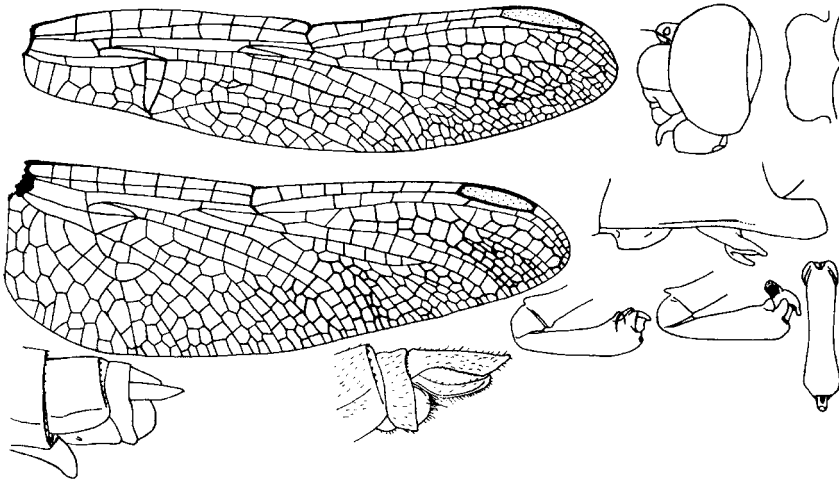


Fig. 3.2.278 *Erythrodiplax nigricans*: fore and hind wing (upper left), head in lateral view (upper right center), posterior lobe of the prothorax (upper right), male genitalia on the second abdominal segment in lateral view (middle right), penis in ventral view (lower right), penes of two specimens in lateral view (lower right center), and apex of the abdomen of a male (lower center) and a female (lower left). Based on Borror (1942).

38. The medial lobe of the penis is larger than the lateral lobes and extends as far or beyond the apex of the median process, which is small and inconspicuous. The frons of the fully developed adult is entirely bluish black without yellow spots (**Fig. 3.2.282**). The thorax of the male is olive brown with a blackish dorsum. The cloud at the base of the male hind wing is blackish with a narrow amber halo. The male abdomen is mainly whitish, with black on the posterior part of the eighth and all of the ninth and tenth segments, including the appendages.

.....*Erythrodiplax clitella* Borror, 1942
 (Chile, Venezuela). The reference to Chile may be a mistake (Borror, 1942).

- The medial lobe of the penis does not extend beyond the apex of the median process, which is usually well developed. The frons of the fully developed adult is bluish black (**Fig. 3.2.281**). The cloud at the base of the hind wing of the male is usually dark brown or blackish, and that on the wing of the female is amber. The male thorax is mainly olive green or dark ferruginous, and the abdomen is generally blackish, except for the pale anal appendages. The female is yellowish to light brown with dark brown on the middle segments of the abdomen.

.....39

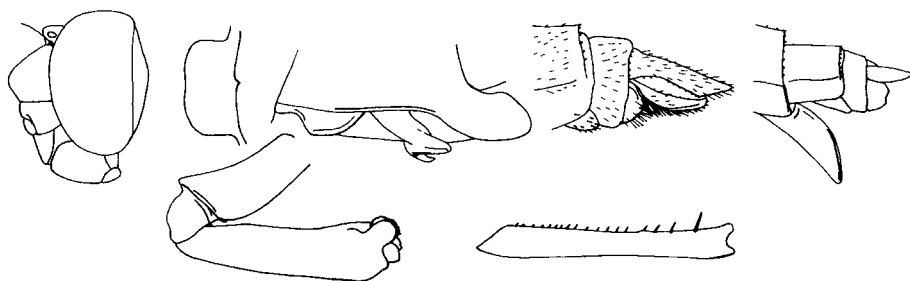


Fig. 3.2.279 *Erythrodiplax hyalina* (above, left to right): head in lateral view, posterior lobe of prothorax, male genitalia on the second abdominal segment in lateral view, apex of the male and female abdomen, and lateral view of penis (lower left), and the hind tibia (lower right). Based on Borror (1942).

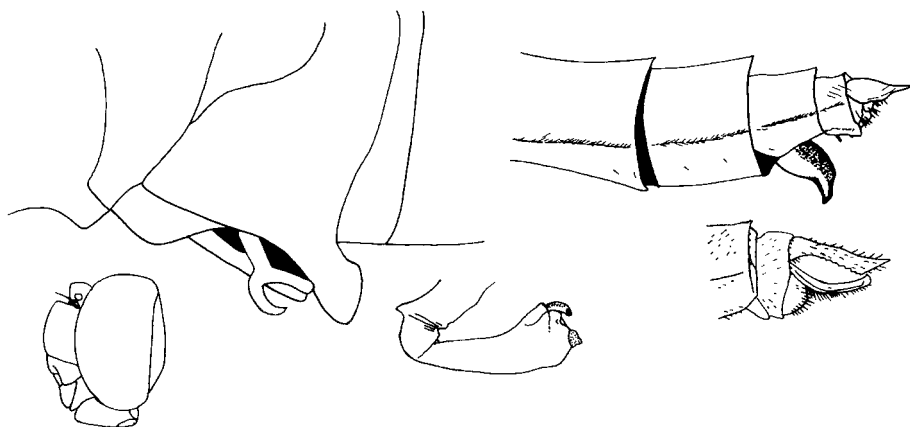


Fig. 3.2.280 *Erythrodiplax atroterminata*: head in lateral view (lower left), male genitalia on the second abdominal segment in lateral view (upper left), penis in lateral view (lower center), apex of a male abdomen (lower right), apical segments of a female abdomen in lateral view (upper right). Based on Borror (1942) and Gloger (1962).

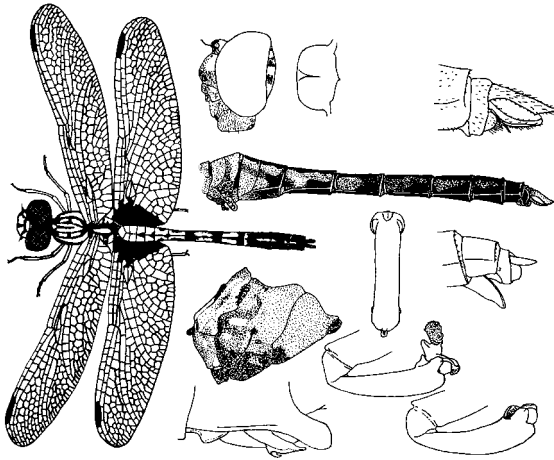


Fig. 3.2.281 *Erythrodiplax basalis*: habitus (left), head in lateral view (upper left center), posterior lobe of the prothorax (upper center), thorax of a male in lateral view (below habitus), thorax and abdomen of a male in lateral view (above habitus to upper middle right), male genitalia on the second abdominal segment in lateral view (lower center), penis in ventral view (right center) and lateral views of the penes of two specimens (lower right), apices of a male (upper right) and a female abdomen (middle right). Based on Kirby (1897) and Borror (1942).



Fig. 3.2.282 *Erythrodiplax clitella* (left to right, all in lateral view): head, male genitalia on the second abdominal segment, penis, apices of a male and a female abdomen. Based on Borror (1942).

39. There are distinct yellow spots ventral to the antenna next to the compound eyes (**Fig. 3.2.281**). Hind wing length: 16.5 to 25 mm. Male chromosome number: $2n = 25$, $n = 13$ (Ferreira *et al.*, 1979).

.....*Erythrodiplax basalis* (Kirby, 1897) pars
(West Indies, Colombia, Venezuela, Peru, Ecuador, Guyana, French Guiana, Rondônia, Amazonas, Pará, Mato Grosso, Mato Grosso do Sul, São Paulo, Rio de Janeiro). Syn: *Microthyria basalis* Kirby, 1897; some references to *Trithemis basifusca* Calvert, 1895; probably *Libellula erratica* Erichson, 1848; *Erythrodiplax basalis basalis* (Kirby, 1897).

- There are no yellow spots ventral to the antenna next to the compound eyes (Fig. 3.2.283).40

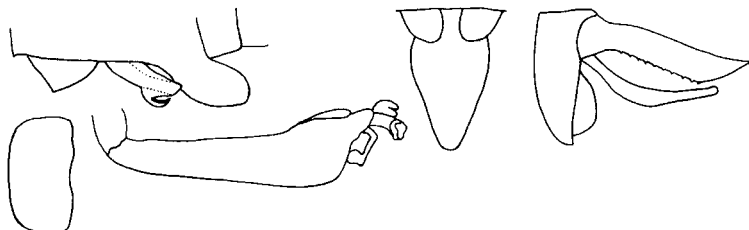


Fig. 3.2.283 *Erythrodiplax chromoptera* male: posterior lobe of the prothorax in dorsal view (lower left), genitalia on the second abdominal segment in lateral view (upper left), apical segment of the penis in lateral view (lower left center), inferior anal appendage in ventral view (right center), and the apex of the abdomen in lateral view (right). Based on Santos (1953b).

40. The male thorax is mainly dark ferruginous, sometimes with a light bluish pruinescence. The cloud at the base of the hind wing of the male is usually dark brown. The pterostigma of the fore-wing is about 4.0 mm. The inferior anal appendage of the male extends beyond the tooth farthest posteriad on the superior anal appendage (Fig. 3.2.283). The terminal segment of the penis is 1.1 to 1.3 mm from the anterior meatus to the apex of the lateral lobe. Hind wing length of male: 25 to 27 mm.

.....*Erythrodiplax chromoptera* Borror, 1942
(Argentina, Uruguay, Rio Grande do Sul, Paraná, São Paulo, Federal District).

- The male thorax is mainly olive green. The cloud at the base of the hind wing of the male is usually blackish. The pterostigma of the fore-wing is 1.8 to 3.6 mm (Fig. 3.2.284). The terminal segment of the penis is 1.8 mm or less from the anterior meatus to the apex of the lateral lobe. Hind wing length: 16.5 to 25 mm.

.....*Erythrodiplax avittata* Borror, 1942
(Surinam, Bolivia, Paraguay, Argentina, Bahia, São Paulo, Rio de Janeiro, and Mato Grosso). Syn: *Erythrodiplax basalis avittata* Borror, 1942.

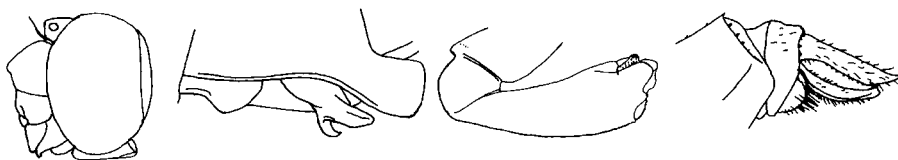


Fig. 3.2.284 *Erythrodiplax avittata* male (left to right, all in lateral view): head, genitalia on the second abdominal segment, penis, and apex of the abdomen. Based on Borror (1942).

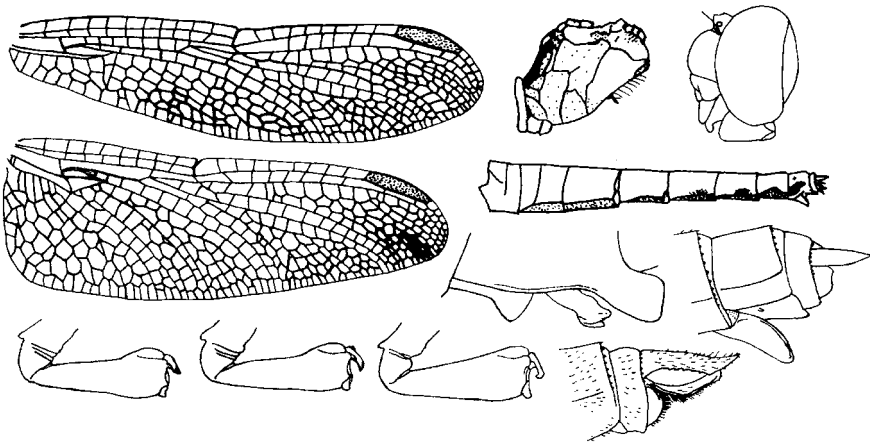


Fig. 3.2.285 *Erythrodiplax media*: fore and hind wings (upper left); lateral views of the head (upper right), thorax (upper right center), abdomen (middle right), male genitalia on the second abdominal segment (right of center), penes of three specimens (lower left to center), and apex of the abdomen of a male (lower right) and a female (lower middle right). Based in part on Borror (1942).

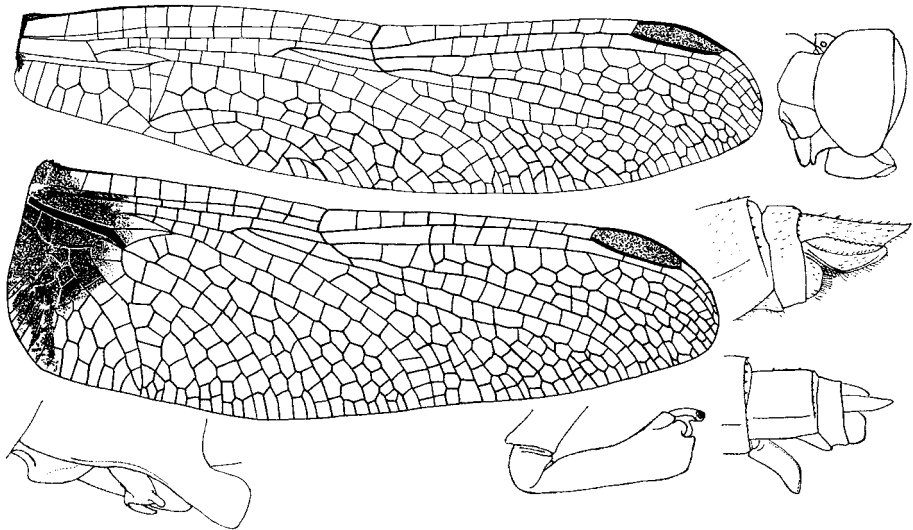


Fig. 3.2.286 *Erythrodiplax ines*: fore and hind wing (upper left) and (right, top to bottom, all in lateral view) head, apex of a male and a female abdomen, and lateral views of the male genitalia on the second abdominal segment (lower left) and the penis (lower right center). Based in part on Borror (1942).

41. The wing tips are brown or black at least as far proximad as the stigma. The hamule is deeply forked. The vulvar lamina of the female is prominent and curved ventrad (**Fig. 3.2.280**). Hind wing length: 20 to 25.5 mm. Female chromosome number: $2n = 26$, $n = 12 + X$ (Mola, 1996).

.....*Erythrodiplox atroterminata* Ris, 1911
(Chile, Argentina, Paraguay, Uruguay, São Paulo, Santa Catarina, Rio Grande do Sul)

- The wing tips are hyaline or very narrowly brown or black (**Fig. 3.2.285**). ...42

42. The terminal segment of the penis is 0.90 to 1.28 mm from the anterior meatus to the apex of the lateral lobe (**Fig. 3.2.285**).43

- The terminal segment of the penis is 1.29 to 1.66 mm from the anterior meatus to the apex of the lateral lobe (**Fig. 3.2.286**).45

43. The terminal segment of the penis viewed laterally is gradually widened distally, its lateral lobes are roughly triangular, and the median process is very slender. The frons and body of the adult are blue-black. The wing tips are hyaline, and the spot on the hind wing is small, extending no more than halfway between the first and second antenodals, slightly beyond the base of a_2 . and three cells caudad to the membranule (**Fig. 3.2.285**). Hind wing length: 21 to 25.5 mm. Male chromosome number: $2n = 22$, $n = 11$ (Ferreira *et al.*, 1979).

.....*Erythrodiplox media* Borror, 1942
(Bolivia, Paraguay, Argentina, Espirito Santo, Minas Gerais, São Paulo, Santa Catarina, Rio Grande do Sul).

- The terminal segment of the penis viewed laterally is rather abruptly widened distally, its lateral lobes rounded or somewhat quadrate and median process rather robust. The frons of the adult is bluish black or reddish brown. The wing tips are hyaline or rarely narrowly lined with brown or black. The spot on the hind wing extends at most to the base of the triangle (**Fig. 3.2.287**). Hind wing length: 17.0 to 27.5 mm.44

44. The frons is reddish or reddish brown. The thorax of the male and the cloud at the base of the hind wing are almost entirely reddish brown (**Fig. 3.2.287**), becoming yellowish on the ventral part of the abdomen and sometimes with a bluish pruinosity on the abdomen. The female is somewhat lighter in color with olive green and ocher on the lateral surfaces of the thorax. Male chromosome number: $2n = 25$, $n = 12 + X$ (Mola, 1996).

.....*Erythrodiplox fusca* (Rambur, 1842)
(North and Central America, West Indies, Colombia, Ecuador, Peru, Venezuela, Guyana, French Guiana, Surinam, Bolivia, Paraguay, Uruguay, Argentina, Amazonas, Pará, Rondônia, Rio Grande do Norte, Bahia, Espirito Santo, Minas Gerais, São Paulo, Rio de Janeiro, Santa Catarina, Rio Grande do Sul, Mato Grosso, Mato Grosso do Sul). Syn: *Libellula fusca* Rambur, 1842; *Libellula incompta* Rambur, 1842; *Erythrodiplox connata fusca* (Rambur, 1842).

- The frons is bluish black. The abdomen of the male is uniform black, and that of the female is blackish with large dark ochraceous patches on the dorsal surfaces of the segments. Beyond the small basal patches, which are blackish in the male and amber in the female, the wings are hyaline with grayish pterostigmas,

bordered anteriorly by black. There is a shallow, broad emargination on the midline of the prothoracic lobe (**Fig. 3.2.288**). Fore and hind wing length: 23.8 to 25.5 mm. Length of female abdomen: 18.2 to 19.6 mm. The thorax of the female is olive green or brown.

.....*Erythrodiplax connata* (Burmeister, 1839)
(North and Central America, West Indies, Colombia, Venezuela, Ecuador, Peru, Argentina, Chile,). Syn: *Libellula connata* Burmeister, 1839; some references to *Trithemis basifusca* Calvert, 1895; *Libellula (Diplax) chloropleura* Brauer, 1865; *Libellula communis* Rambur, 1842; *Diplax fraterna* Hagen, 1873; *Libellula leontina* Brauer, 1865. Borror (1942) recognized three subspecies, two of which are now recognized as independent species: *Erythrodiplax fusca* and *E. minuscula* (Rambur, 1842), the latter confined to North America and recognized by its bluish black frons and hind wing length of 17 to 20 mm.

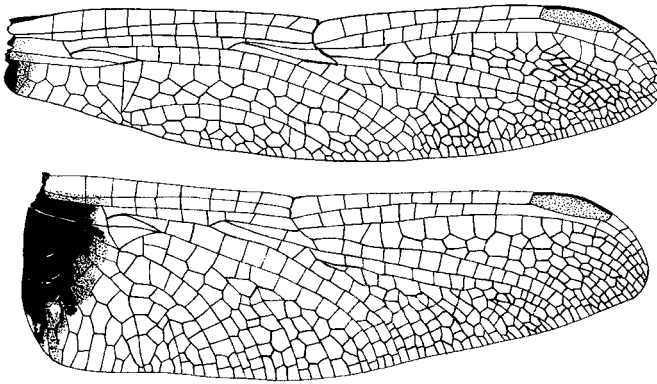


Fig. 3.2.287 Fore and hind wing of *Erythrodiplax fusca*.

45. The basal spot on the hind wing is large and triangular, extending to the apex of the triangle with the distal margin forming nearly a straight line from the apex of the triangle to the anal angle of the wing (**Fig. 3.2.286**). The terminal segment of the penis lacks an apical tubercle. The frons, body, and wing spot of the adults are dark red. Hind wing length: 27 to 33 mm. Almost the entire head and body of the male, including the clouded area of the wing and the pterostigma, are reddish brown. The posterior margins of the abdominal segments have narrow blackish margins.

.....*Erythrodiplax ines* Ris, 1911
(Colombia, Ecuador, Peru, Bolivia, at elevations above 1000 m).

- The basal spot on the hind wing is relatively small, extending at most to the base of the triangle. The terminal segment of the penis usually has an apical tubercle (**Fig. 3.2.288**). Hind wing length: 21 to 29.5 mm.46

46. The frons of the adult is very dark red, often with a bluish tinge but never blue-black. The thorax and wing spot of the adult are very dark reddish brown

but never black (**Fig. 3.2.289**). The abdomen of the male is dull grayish blue. The pterostigma is dark brown. Male chromosome number: $2n=25$, $n=12 + X$ (Mola, 1996).

.....*Erythrodiplax melanorubra* Borror, 1942
(Venezuela, Colombia, Ecuador, Peru, Chile, Argentina, Bolivia, Paraguay, São Paulo).

- The frons of the adult is blue-black. The thorax and wing spot of the adult are blackish brown or black (**Fig. 3.2.290**).47

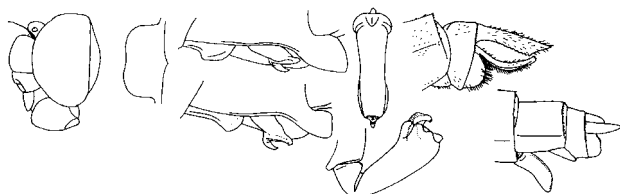


Fig. 3.2.288 *Erythrodiplax connata* (left to right): head in lateral view, posterior lobe of the pronotum, male genitalia on the second abdominal segment of two different specimens in lateral view (above and below), penis in ventral (above) and lateral view (below), apex of the abdomen of a male (above) and a female (below). Based on Borror (1942).

47. The basal spot of the hind wing is small, extending at most to the cubital cross-vein and apex of the membranule (**Fig. 3.2.290**). Hind wing length: 21.5 to 26.5 mm. The male is blackish with the abdomen becoming bluish gray with age.

.....*Erythrodiplax cleopatra* (Ris, 1911)
(Peru, Chile).

- The basal spot on the hind wing is larger (**Fig. 3.2.291**).48

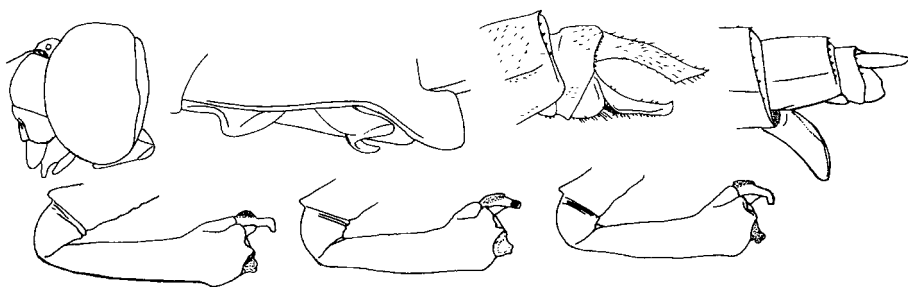


Fig. 3.2.289 *Erythrodiplax melanorubra* (above, left to right): head, male genitalia on the second abdominal segment, apex of the abdomen of a male and a female, and (below): lateral views of the penes of three specimens. Based on Borror (1942).

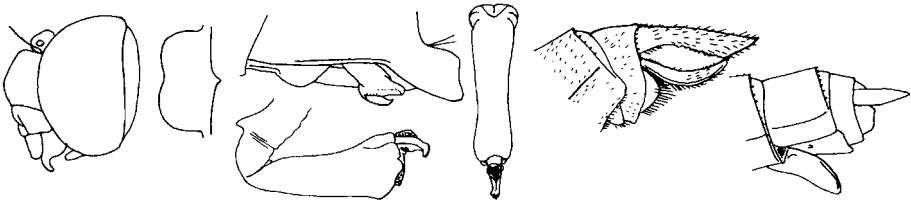


Fig. 3.2.290 *Erythrodiplox cleopatra* (left to right): head in lateral view, posterior lobe of the pronotum, male genitalia on the second abdominal segment in lateral view (above), penis in lateral (below) and ventral view, and the apex of the abdomen of a male and a female. Based on Borror (1942).

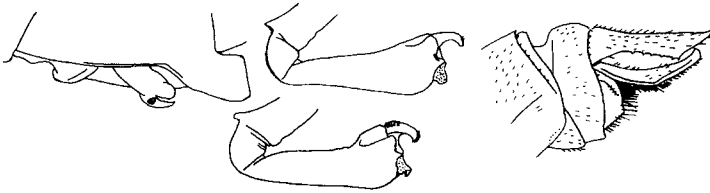


Fig. 3.2.291 *Erythrodiplox cauca* (left to right): male genitalia on the second abdominal segment in lateral view, penes of two specimens in lateral view, and apex of the male abdomen in lateral view. Based on Borror (1942).

48. The outer branch of the hamule is no longer than the inner branch, broadly rounded at the apex, and without a distinct lateral keel. The terminal segment of the penis bears an apical tubercle. The basal spot on the hind wing usually reaches the base of the triangle (**Fig. 3.2.291**). Hind wing length: 24 to 26.5 mm.

.....*Erythrodiplox cauca* Borror, 1942 (Colombia).

- The outer branch of the hamule is as long or longer than the inner branch, somewhat pointed at the apex, and with a more or less distinct lateral keel. The terminal segment of the penis lacks an apical tubercle. The basal spot on the hind wing does not extend beyond the base of the A_2 (**Fig. 3.2.292**). The spot is blackish in the male to amber in the female. Hind wing length: 25 to 29.5 mm. The general coloration is dark, with a blackish abdomen in the male and a dark brown one in the female. The thorax of the male is usually dark brown, and that of the female is orange with an olive green tinge.

.....*Erythrodiplox abjecta* (Rambur, 1842) (Mexico, Central America, West Indies, Colombia, Ecuador, Venezuela, Mato Grosso, Mato Grosso do Sul). Syn: *Libellula connata abjecta* Rambur, 1842; *Erythrodiplox ponderosa* Karsch, 1891.

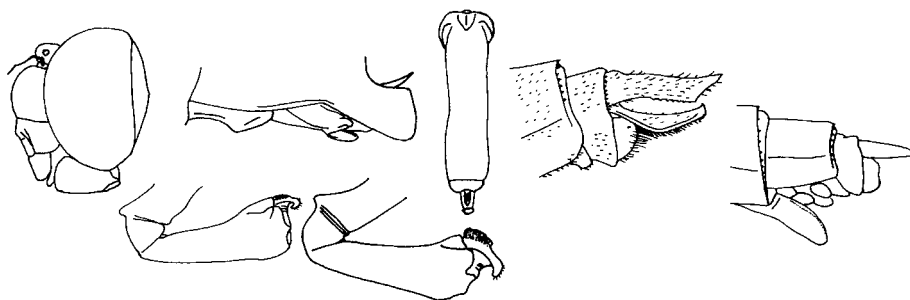


Fig. 3.2.292 *Erythrodiplax abjecta* (above, left to right), head in lateral view, male genitalia on the second abdominal segment in lateral view, penis in ventral view, and the apices of a male and a female abdomen, and (below) penes of two specimens in lateral view. Based on Borror (1942).

49. The wings are hyaline from their brownish bases to a dark brown mark that runs from a point just beyond the proximal border of the pterostigma to the apex and from the anterior to the posterior margin of each wing (**Fig. 3.2.272**). The costal vein is reddish brown from the nodus to the wing tip, while all other veins are brownish black. Except for metallic bluish areas and yellow marks on the vertex or occiput, the head is blackish. The thorax is entirely dull black except for brownish areas at the wing bases. The superior anal appendage is brownish yellow, and the rest of the male abdomen is entirely dull black with some dark pruinose areas. Length of male abdomen with appendages: c. 18 mm. Hind wing length of male: about 18.5 to 21.0 mm. Male chromosome number: $2n = 25$, $n = 12 + X$ (Mola, 1996).

.....*Erythrodiplax lygaea* Ris, 1911
(Argentina, São Paulo, Minas Gerais).

- The apices of the wings are, at most, only slightly clouded along the apical margin, although clouding may be present proximal to the apex (**Fig. 3.2.293**). In case of doubt, the hind wing is longer than 20 mm.50
50. Penis with paired internal lobes and lacking a posterior lobe. The stigma in the fore-wing is usually less than 3 mm in length. There is only one row of cells between R_s and M_2 . There are usually 4 to 7 marginal cells in the discoidal field of the fore-wing (**Fig. 3.2.273**). Length of male abdomen: 19 to 23.5 mm. Hind wing length: 23 to 27 mm. Length of pterostigma: 2.3 to 3.0 mm.

.....*Erythrodiplax naeva* (Hagen, 1861) pars
(North and Central America, West Indies, Colombia, Venezuela). Syn: *Dythemis naeva* Hagen, 1861. Also in couplet 29.

- The penis lacks paired internal lobes and usually has a posterior lobe (**Fig. 3.2.293**).51

51. The median process of the penis terminates in a single, heavily sclerotized, spine-like process directed ventrad. The wings are hyaline with a small brownish

basal spot on the hind wing extending at most to the cubital cross vein and apex of membranule (**Fig. 3.2.274**). Length of hind wing: 23 to 24.5 mm. The male is dark reddish brown with blackish markings. Beyond the basal spot, the wings are hyaline with blackish or grayish veins. The pterostigma is blackish.

.....*Erythrodiplax acantha* Borror, 1942
(São Paulo).

- The median process of the penis does not terminate in a heavily sclerotized, spineline process (**Fig. 3.2.293**).52

52. The median process of the penis is bilobed with the lobes extending ventrad. The metallic blue-black frons has a violet luster and is somewhat flattened (**Fig. 3.2.277**). Length of hind wing: 20 to 26 mm. Most of the body of the male is a uniform dark blue. The anal appendages are light brown.

.....*Erythrodiplax juliana* Ris, 1911 pars
(Colombia, Peru, Venezuela, Bolivia, Argentina, Amazonas, Minas Gerais, Espirito Santo, São Paulo). Also in couplet 34.

- The median process of the penis is not bilobed (**Fig. 3.2.293**).53

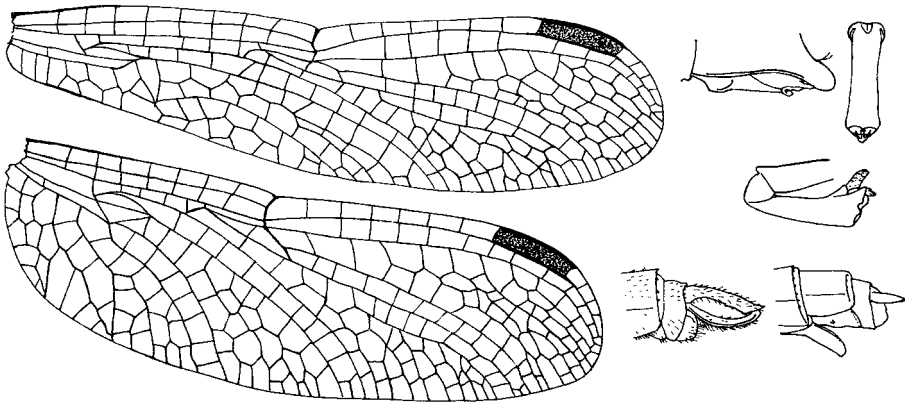


Fig. 3.2.293 *Erythrodiplax tenuis*: fore and hind wing (left), male genitalia on the second abdominal segment in lateral view (upper right center), apex of penis in ventral (upper right) and lateral view (middle right), apex of a male (lower right center) and female abdomen (lower right). Based in part on Borror (1942).

53. The last antenodal cross vein in the fore-wing is complete (**Fig. 3.2.293**). Length of male abdomen: 14.5 to 16 mm. Hind wing length of male: 16.5 to 18 mm. In both sexes, the frons is blackish with a pair of bright blue markings. The thorax and abdomen of the male have contrasting light and dark matt blue

markings. The wings are hyaline with dark brown pterostigmas, which are 2.1 to 2.4 mm long.

.....*Erythrodiplax tenuis* Borror, 1942
(Ecuador, Peru, Rondônia, São Paulo).

- The last antenodal cross vein in the fore-wing is usually incomplete (**Fig. 3.2.294**). Hind wing length: 15 to 27.5 mm.54

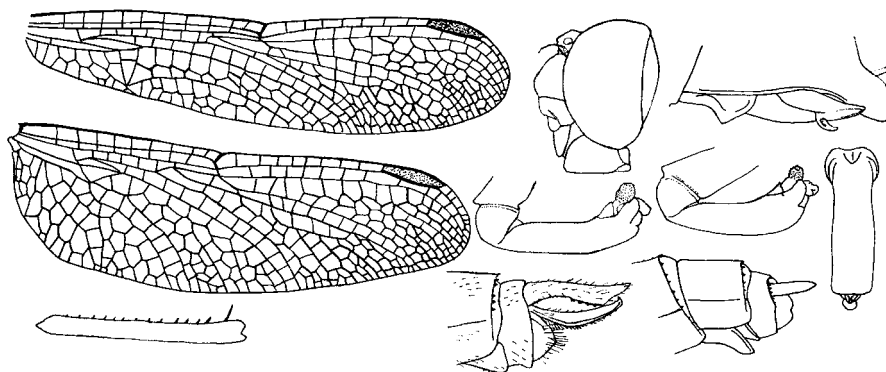


Fig. 3.2.294 *Erythrodiplax andagoya*: fore and hind wing (upper left), head in lateral view (upper center), male genitalia on the second abdominal segment in lateral view (upper right), penis in ventral view (lower right) and lateral views of the penes of two specimens (center and right center), hind femur (lower left), and apex of the abdomen of a male (lower center) and a female in lateral view (lower right center). Based in part on Borror (1942).

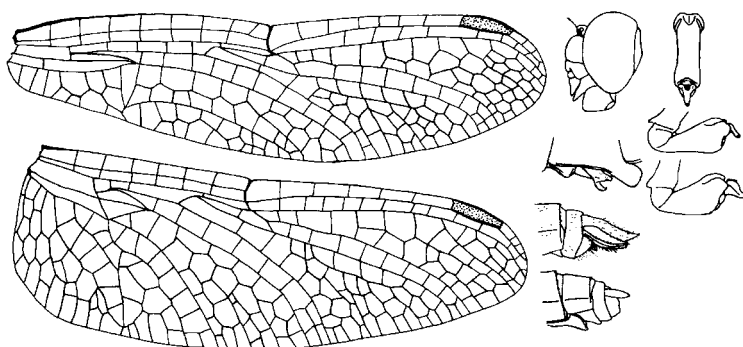


Fig. 3.2.295 *Erythrodiplax paraguayensis*: fore and hind wing (left), and (right center, top to bottom): head in lateral view, male genitalia on the second abdominal segment in lateral view, apices of the male and female abdomen in lateral view, and (right, top to bottom): penis in ventral view and lateral views of the penes from two specimens. Based on Borror (1942).

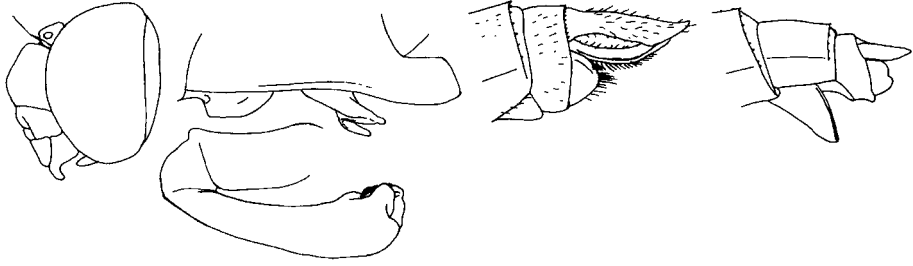


Fig. 3.2.296 *Erythrodiplax nivea* (left to right): head in lateral view, lateral views of the male genitalia on the second abdominal segment (above) and the penis (below), and the apex of a male and a female abdomen in lateral view. Based on Borror (1942).

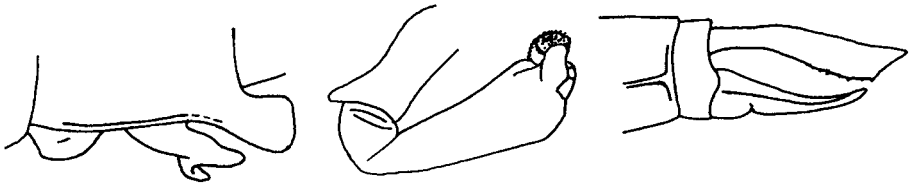


Fig. 3.2.297 *Erythrodiplax pallida* male (left to right, all in lateral view): genitalia on the second abdominal segment, penis, and apex of the abdomen. Based on Borror (1942).

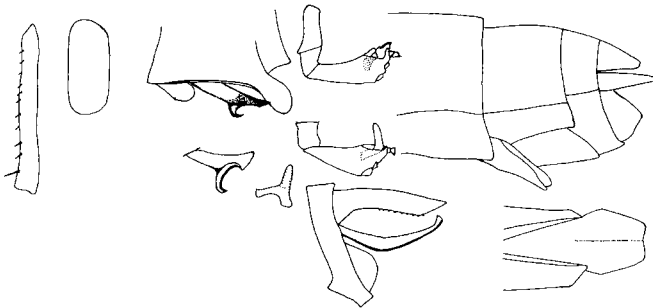


Fig. 3.2.298 *Erythrodiplax gomesi* (left to right): hind femur of a male, posterior lobe of the male prothorax, male genitalia on the second abdominal segment (above) and the hamule in anterior view (below left) with the median process of the penis and posterior lobe in lateral view (below right), penes of two specimens in lateral view (above and middle) and the anal appendages of a male in lateral view (below), apex of the female abdomen (above) and the valve of the vulva in ventral view (below). Based on Santos (1946d).

54. The penis has a well-developed posterior lobe, which, when erect, is a sac or mitten-like structure extending dorsad from the apex of the penis, but when not erect, is drawn back into the apex of the penis, where it is inconspicuous. The median process of the penis does not extend beyond the apex of the median lobes to a distance equal to or greater than the length of the lateral lobes. (**Fig. 3.2.278**).55
- The penis has poorly developed posterior lobes, or such lobes are lacking. The median process of the penis extends beyond the apex of the median lobes to a distance at least equal to the length of the lateral lobes (**Fig. 3.2.295**).63

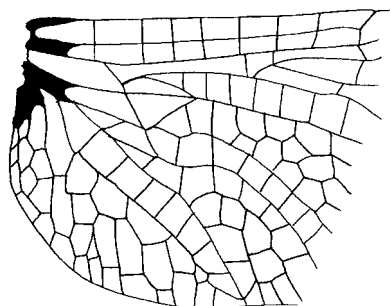


Fig. 3.2.299 Base of the hind wing of *Erythrodiplax branconensis*. Based on Sjöstedt (1929).

55. The median process of the penis extends beyond the apex of the median lobes to a distance almost equal to the length of the lateral lobes. The apex of the median process of the penis is usually rounded and bears a few bristles, but it is not foot-shaped when erect. The frons is rounded and lacks a distinct anterior edge and two distinct dorsal tubercles; in the adult it is blue-black without yellow lateral spots. The penultimate spine at the outer angle of the hind femur is no more than one third as long as the ultimate spine (**Fig. 3.2.278**). Hind wing length: 19 to 25 mm. The thorax of the male is dark brown, and the abdomen is blackish with obscure reddish brown lateral markings, usually most prominent on the sixth and seventh abdominal segments. The wings are hyaline with brown veins or there is an amber subapical cloud. The pterostigma is yellowish with darker anterior and posterior margins.

.....*Erythrodiplax nigricans* (Rambur, 1842)
(Argentina, Uruguay, Paraguay, Rio Grande do Sul, Rio de Janeiro). Syn:
Libellula nigricans Rambur, 1842; *Libellula vilis* Rambur, 1842.

- The median process of the penis extends slightly or not at all beyond the apex of the median lobes. The apex of the median process of the penis does not bear bristles. The penultimate spine at the outer angle of the hind femur is one half as long as the ultimate spine or longer (**Fig. 3.2.296**).56

56. The terminal segment of the penis is 1.7 mm or more from the anterior meatus to the apex of the lateral lobe. The pterostigma of fore-wing is 3.1 to 4.1 mm long (**Fig. 3.2.296**). Hind wing length: 23 to 27.5 mm.57
- The terminal segment of the penis is 1.6 mm or less from the anterior meatus to the apex of the lateral lobe. Pterostigma of fore-wing: 1.8 to 3.6 mm long (**Fig. 3.2.297**). Hind wing length: 16.5 to 25 mm.58
57. The terminal segment of the penis is 1.85 to 2.05 mm from the anterior meatus to the apex of the lateral lobe. The basal spot in the hind wing is small and extends distad a maximum of one cell beyond the cubital cross vein and caudad not beyond the apex of the membranule; it is not bordered distally by an opal band (**Fig. 3.2.279**). Hind wing length: 23 to 27.5 mm.58
-*Erythrodiplax hyalina* (Förster, 1907) pars (Paraguay, Uruguay, São Paulo, Santa Catarina, Rio Grande do Sul). Also in couplet 37.
- The terminal segment of the penis is 1.70 to 1.81 mm from the anterior meatus to the apex of the lateral lobe. The basal spot in the hind wing is large extending distad at least to the base of A_2 and caudad 2 to 4 cells distal of the membranule; it is usually bordered distally by an opal band (**Fig. 3.2.296**). Hind wing length: 24 to 26 mm.59
-*Erythrodiplax nivea* Borror, 1942 (São Paulo).
58. The frons of teneral specimens is greenish yellow, washed with chalybeous blue dorsally. Fully formed adults have not been described, and specimens can be distinguished with certainty only by examining the structure of the penis, which has large posterior lobes covered with long hair-like setae and a large, heavily sclerotized basal portion (**Fig. 3.2.297**). Hind wing: 22 mm.59
-*Erythrodiplax pallida* (Needham, 1904) (São Paulo). Syn: *Micrathyria pallida* Needham, 1904.
- The frons is predominantly blue-black, and the penis is not as described for *E. pallida* (**Fig. 3.2.294**).59
59. The frons of the adult is entirely bluish black without yellow lateral spots (**Fig. 3.2.294**). Length of male abdomen: 19 to 22 mm. Hind wing length of male: 21.5 to 24.5 mm. The entire body of the male is bluish black with only a few paler markings, such as those on the anal appendages, at the wing bases, and on the anterolateral parts of the thorax. The female is lighter in color with a reddish brown to ochraceous thorax and reddish brown abdomen, becoming darker toward the apex. Beyond the small clouds at the bases, the wings are hyaline or with a slight amber tone and brown pterostigmas, which are 2.4 to 3.3 mm long.60
-*Erythrodiplax andagoya* Borror, 1942 (Central America, Colombia, Ecuador).
- The frons of the adult is blue-black with a small yellow spot on each side next to the compound eye and ventral to the insertion of the antenna (**Fig. 3.2.298**). Hind wing length: 16.5 to 25 mm.60

60. The triangle in the fore-wing is crossed. The superior anal appendage is black. The thorax is covered by a bluish pruinescence. There are usually 10½ antenodal cross veins in the fore-wing and three rows of cells beyond the triangle in the discoidal field.

.....*Erythrodiplax anomala* (Brauer, 1865)
(Argentina, Rio de Janeiro, São Paulo). Syn: *Libellula (Diplax) anomala* Brauer, 1865. This and the following three poorly-defined species form the so-called “*basalis* group” of Santos (1946d); they are hard to distinguish, and some may actually be conspecific.

- The triangle in the fore-wing is usually not crossed.61
61. The subtriangle is usually divided into three cells (**Fig. 3.2.299**). The coloration of the labrum and labium is not dark or medium ferrugineous.

.....*Erythrodiplax branconensis* Sjöstedt, 1929
(Brazil). Syn: *Erythrodiplax bromeliicola* Westfall in Needham, Westfall, and May, 2000.

- The subtriangle is usually divided into two cells.62
62. The lateral lobe of the penis is not notably long and narrow and does not extend beyond the apex of the median process. There are distinct yellow spots ventral to the antenna next to the compound eyes on an otherwise bluish black frons (**Fig. 3.2.281**). Hind wing length: 16.5 to 25 mm.

.....*Erythrodiplax basalis* (Kirby, 1897)
(West Indies, Colombia, Venezuela, Peru, Ecuador, Guyana, French Guiana, Surinam, Bolivia, Paraguay, Argentina, Rondônia, Amazonas, Pará, Mato Grosso, Mato Grosso do Sul, São Paulo, Rio de Janeiro). Syn: *Micrathyria basalis* Kirby, 1897; some references to *Trithemis basifusca* Calvert, 1895; probably *Libellula erratica* Erichson, 1848.

- In the male, the lateral lobe of the penis is long and narrow but somewhat variable in shape (**Fig. 3.2.298**). Abdomen, including appendices: 17 to 18 mm long. Hind wing length: 20 to 21 mm. Length of pterostigma: c. 3 mm. Length of superior anal appendage: 1.2 mm. Color: The labrum is ferrugineous; the labium and most of face are dark ferrugineous; the clypeus has yellow lateral markings; the frons and vertex are metallic blue or violet. There are yellow lateral markings on the occiput. The prothorax is light yellow, and the synthorax is yellowish orange to red. The legs are dark reddish brown. The wings are hyaline with golden yellow markings at the bases and light brown pterostigmas and membranulae. The abdomen is dark brown with yellow lateral stripes interrupted by darker markings at the articulations and dark yellow anal appendages. Its second and third segments have bright red markings dorsally, and the first three are yellow ventrally.

.....*Erythrodiplax gomesi* Santos, 1946
(São Paulo, Paraná).

63. Viewed laterally, the lateral lobes of the penis are at least half as wide at the base as at the apex of the terminal segment. The triangle of the fore-wing is usually free (**Fig. 3.2.295**). Hind wing length: 15 to 20 mm. The male may be

uniform dark bluish, especially in old age. The wings of the male are hyaline. The pterostigma is gray with darker borders.

.....*Erythrodiplax paraguayensis* (Förster, 1904)
(Ecuador, Venezuela, Guyana, Surinam, Bolivia, Paraguay, Argentina, Minas Gerais, São Paulo, Rio Grande do Sul, Mato Grosso, Mato Grosso do Sul). Syn: *Diplacodes paraguayensis* Förster, 1904.

- The lateral lobes of the penis are not more than one third as wide at the base as the apex of the terminal segment of the penis viewed laterally. The triangle of the fore-wing is usually crossed (**Fig. 3.2.285**). Hind wing length: 17 to 27.5 mm.64

64. The terminal segment of the penis viewed laterally is gradually widened distally, its lateral lobes are roughly triangular, and the median process is very slender. The frons and almost the entire body of the adult are blue-black. The wings are hyaline at their apices, and the spot on the hind wing is small, extending no more than halfway between the first and second antenodal cross veins, slightly beyond the base of A_2 , and three cells caudad to the membranule (**Fig. 3.2.285**). Hind wing length: 21 to 25.5 mm.

.....*Erythrodiplax media* Borror, 1942
(Bolivia, Paraguay, Argentina, Espirito Santo, Minas Gerais, São Paulo, Santa Catarina, Rio Grande do Sul). Also see Couplet 42.

- The terminal segment of the penis, viewed laterally, is rather abruptly widened distally; its lateral lobes rounded or somewhat quadrate, and its median process is rather robust. The frons of the adult is bluish black or reddish brown. The wing tips are hyaline or rarely narrowly lined with brown or black. The spot on the hind wing extends, at most, to the base of the triangle (**Fig. 3.2.288**). Hind wing length: 17.0 to 27.5 mm.

.....*Erythrodiplax connata* (Burmeister, 1839)
(North and Central America, West Indies, Colombia, Venezuela, Ecuador, Peru, Argentina, Chile.). Syn: *Libellula connata* Burmeister, 1839; some references to *Trithemis basifusca* Calvert, 1895; *Libellula (Diplax) chloropleura* Brauer, 1865; *Libellula communis* Rambur, 1842; *Diplax fraterna* Hagen, 1873; *Libellula leontina* Brauer, 1865. Borror (1942) recognized three subspecies, one of which is now recognized as an independent species: *Erythrodiplax fusca*. His third subspecies is now also recognized as an independent species: *E. minuscula* (Rambur, 1842), confined to North America and recognized by its bluish black frons and hind wing length of 17 to 20 mm.

65. The thorax has a small blackish, comma-shaped mark across the metepisternum below the spiracle. The black dorsal stripe on the abdomen is confined to the eighth and ninth segments. There are $7\frac{1}{2}$ to $8\frac{1}{2}$ antenodal and 6 to 8 postnodal cross veins on the fore-wing. The costal vein is yellow, and the pterostigma is orange with darker anterior and posterior borders. The base of the wing has a dark orange-brown stripe from the base to a point between the second and fourth antenodal cross vein and to the proximal border of the subtriangle (**Fig. 3.2.261**). This basal spot is usually larger in specimens from Argentina than those from Chile. Length of female abdomen: 19 to 23.5 mm.

Hind wing length of female: 26 to 27.5 mm. Length of pterostigma: 2.5 to 3.5 mm.

.....*Erythrodiplax corallina* (Brauer, 1865).
(Peru, Chile, Uruguay, Argentina). Syn: *Libellula* (*Diplax*) *corallina* Brauer, 1865; *Sympetrum medium* Navás, 1916; *Erythrodiplax nutrina* Förster, 1914; *Libellula plebeia* Rambur (nec Burmeister, 1839), 1842.

- The costal vein is usually dark brown or black, or if not, the combination of other characteristics is not present (**Fig. 3.2.249**).66

66. The vulvar lamina is not more than half as long as the ninth segment (**Fig. 3.2.271**).67

- The vulvar lamina is more than half as long as the ninth segment (**Fig. 3.2.283**).83

67. The vulvar lamina is one third as long as the ninth segment or shorter, and it is not narrowed at the apex in lateral view. The posterior lobe of the prothorax is rounded and narrowed distally, or its posterior margin is prominent, slightly inclined along the midline, and bears a prominent fringe of long, white, hair-like setae (**Fig. 3.2.271**).68

- The vulvar lamina is usually half as long as the ninth segment, but if it is less than half as long, then the apex is not narrowed but broadly rounded in lateral view. The posterior lobe of the prothorax is somewhat quadratic and not narrowed distally (**Fig. 3.2.256**).71

68. There is no prominent basal spot on either wing. Both wings have only faint streaks of golden yellow in the subcostal, cubital, and anal areas; dark brown pterostigmas; and smoky wing tips. There are usually $9\frac{1}{2}$ or $10\frac{1}{2}$ antenodal cross veins in the fore-wing and 8 in the hind wing. The thorax is mainly yellowish green with brown markings. The prominent posterior margin of the prothorax is fringed with long, white, hair-like setae. The abdomen is dark brown with yellow dorsolateral spots of the first six segments; they are dark brown or black ventrally. The anal appendages are yellow speckled with brown. The vulvar lamina is broadly rounded and slightly concave at the apex (**Fig. 3.2.271**). Total length of female: 28 to 30 mm; abdomen length of female: 17 to 19.5 mm; hind wing length: 22 to 24 mm. Pterostigma length: 2.5 to 2.8 mm.

.....*Erythrodiplax longitudinalis* (Ris, 1919)
(Venezuela, French Guiana, Surinam, Amazonas, Mato Grosso do Sul). Syn: *Anatya longitudinalis* Ris, 1919.

- There are prominent basal spots on the fore and hind wings, and, if these markings are weak, the abdomen is predominantly light in color dorsally or ventrally, or the hind wing does not exceed 22 mm (**Fig. 3.2.276**).69

69. The vulvar lamina projects at an angle of 45° or more. The basal spot in the fore-wing is about as dark as that in the hind wing (**Fig. 3.2.276**). Hind wing length: at least 22 mm.

.....*Erythrodiplax famula* (Erichson, 1848)
(West Indies, Surinam, Guyana, French Guiana, Venezuela, Pará, Minas Gerais, São Paulo, Mato Grosso?). Syn: *Libellula famula* Erichson, 1848; *Erythrodiplax ochracea aequatorialis* Ris, 1911.

- The vulvar lamina projects at an angle of 30° or less (**Fig. 3.2.260**).70
 70. There is a very narrow dark stripe along the dorsal carina of the abdomen; viewed laterally, the abdomen appears light dorsally and dark ventrally. The basal spot on the fore-wing is paler than that on the hind wing. The apex of the vulvar lamina is truncate or slightly emarginate (**Fig. 3.2.260**). Hind wing length: 20.5 to 25.0 mm.

.....*Erythrodiplax latimaculata* (Ris, 1911)
 (Venezuela, Guyana, Argentina, Bolivia, Minas Gerais, Bahia, Rio de Janeiro, São Paulo, Amazonas, Mato Grosso).

- There is a broad dark stripe along the dorsal carina of the abdomen; viewed laterally, the abdomen appears dark with a light lateral band. The basal spot on the fore-wing is about as dark as that on the hind wing. The apex of the vulvar lamina is rounded (**Fig. 3.2.275**). Hind wing length: 17.5 to 22 mm.

.....*Erythrodiplax fulva* Borrer, 1957
 (French Guiana, Venezuela).

71. The penultimate spine at the outer angle of the hind femur is not more than 25% the length of the ultimate spine. The apex of the vulvar lamina is broadly rounded in lateral view, and its caudal margin is nearly perpendicular to the lateral margin of the ninth segment (**Fig. 3.2.256**). Length of abdomen of female: c. 22 mm. Hind wing length of female: c. 27 mm. Length of pterostigma: 2.3 to 3.3 mm.

.....*Erythrodiplax solimaea* Ris, 1911
 (Peru, Venezuela, Amazonas).

- The penultimate spine at the outer angle of the hind femur is at least 1/3 of the length of the ultimate spine (**Fig. 3.2.249**).72

72. In lateral view, the dorsoposterior side of the vulvar lamina and sometimes other sides, as well, is convex with a pointed or somewhat rounded apex; if this feature is doubtful, then the frons is yellowish, greenish, or brownish without any blue markings (**Fig. 3.2.249**).73

- In lateral view, the vulvar lamina is somewhat triangular with nearly straight sides and a pointed apex; the frons of some species is marked with blue (**Fig. 3.2.257**).75

73. The lateral margins of the middle segments of the abdomen are light brown without distinct markings, although obsolete pale areas are usually present on the seventh and eighth segments. The thorax is light brown with a single broad yellow stripe running its full length and horizontal to the body axis. The basal segments of the female abdomen are olive green. The wings of females are mainly hyaline with blackish veins, dark brown pterostigmas, yellowish at the bases, and darkly clouded at the apices. The vulvar lamina is barely half the length of the ninth segment (**Fig. 3.2.249**). Total length: c. 34 to 35 mm. Length of abdomen: c. 23 mm. Hind wing length: c. 28 mm.

.....*Erythrodiplax lativittata* Borrer, 1942
 (Venezuela, Colombia, Peru, Argentina, Brazil).

- The abdomen has distinct lateral markings, at least on the fourth through seventh segments. The thorax is not marked with a single prominent broad yellow horizontal stripe.74

74. The penultimate spine at the outer angle of the hind femur is not more than 1/3 of the length of the ultimate spine. Each of the wings often has a brown or gray area behind the stigma, which is yellowish with darker borders. There is no distinct dark antehumeral stripe. The lateral stripes on the fourth through seventh segments are usually not interrupted on the anterior half of each segment (**Fig. 3.2.278**). Hind wing length: 22 to 24.5 mm. The head and thorax of the female are light olive green, and the abdomen is brownish yellow with blackish dorsal and lateral markings. The apical segments may be somewhat reddish.

.....*Erythrodiplax nigricans* (Rambur, 1842)
(Argentina, Uruguay, Paraguay, Rio Grande do Sul, Rio de Janeiro).

- The penultimate spine at the outer angle of the hind femur is at least half the length of the ultimate spine. The wings never have a brown or gray spot behind the stigma. There is usually a distinct dark antehumeral stripe. The lateral stripes on the fourth through seventh segments are usually interrupted on the anterior half of each segment (**Fig. 3.2.288**). Hind wing length: 17 to 25.5 mm.

.....*Erythrodiplax connata* (Burmeister, 1839)
(North and Central America, West Indies, Colombia, Venezuela, Guyana, French Guiana, Ecuador, Peru, Uruguay, Argentina, Chile, Paraguay, Bolivia, Amazonas, Pará, Rondônia, Rio Grande do Norte, Bahia, Espírito Santo, Minas Gerais, São Paulo, Rio de Janeiro, Santa Catarina, Rio Grande do Sul, Mato Grosso).

75. Cu_1 in the hind wing arises from the anal angle of the triangle or very close to it (**Fig. 3.2.257**).76

- Cu_1 in the hind wing arises well separated from the anal angle of the triangle. The frons is always marked with metallic blue (**Fig. 3.2.270**).81

76. The frons is partly or entirely metallic blue (**Fig. 3.2.257**).77

- The frons is greenish, brownish, or yellowish without blue markings (**Fig. 3.2.265**).79

77. Viewed laterally, the dorsoposterior edge of the vulvar lamina forms an angle of no more than 60° with the lateral margin of the ninth segment. The tip of the vulvar lamina is bent slightly caudad. The blue marking on the frons is usually restricted to the portion just below the median ocellus and occupies no more than half of the area of the frons (**Fig. 3.2.257**). Hind wing length: 23.5 to 27.5 mm. The head and thorax of the female are dark yellow or greenish yellow. The abdomen of the female is dark brown with dark yellow lateral markings on most of the segments.

.....*Erythrodiplax kimminsi* Borrer, 1942
(Panama, Colombia, Peru, Venezuela, Ecuador, Mato Grosso do Sul). *Trithemis erichsoni* Kirby, 1994 (pars).

- Viewed laterally, the dorsoposterior edge of the vulvar lamina forms an angle of almost 90° with the lateral margin of the ninth segment. The tip of the vulvar

lamina is not obviously bent caudad. The blue marking on the frons usually covers half or more of the area at the front of the frons (**Fig. 3.2.262**).78
 78. Viewed from behind, the tip of the vulvar lamina is usually narrowly rounded (**Fig. 3.2.262**). Length of female abdomen: 19 to 21 mm. Hind wing length of female: 24 to 28 mm. Length of pterostigma: 2.4 to 3.1 mm. The female is sometimes brownish yellow with reddish brown on the apical segments of the abdomen and sometimes blackish with a violet tinge to the thorax. The wing membrane is usually brownish, at least on the apical part of the wing.

.....*Erythrodiplax unimaculata* (De Geer, 1773)
 (West Indies, Guyana, Surinam, Colombia, Peru, Paraguay, Bolivia, Pernambuco, Bahia, Rio de Janeiro, São Paulo, Pará, Amazonas, Mato Grosso, Mato Grosso do Sul). Syn: *Libellula unimaculata* De Geer, 1773; *Diplax unimaculata* (De Geer, 1773) Hagen, 1861; *Trithemis unimaculata* (De Geer, 1773) Kirby, 1890; *Libellula pulla* Burmeister, 1839; *Micrathyrja hemimelaena* Karsch, 1890; *Trithemis erichsoni* Kirby, 1897.

- Viewed from behind, the tip of the vulvar lamina is broadly rounded (**Fig. 3.2.264**). Length of female abdomen: c. 21 mm. Hind wing length of female: c. 25 mm. Length of pterostigma: 2.6 to 2.9 mm.

.....*Erythrodiplax laurentia* Borrer, 1942
 (Venezuela, Guyana, French Guiana, Surinam, Pará). Syn: *Trithemis erichsoni* Kirby, 1994 (pars).

79. The hind wing is 20 to 22 mm in length (**Fig. 3.2.265**). Length of pterostigma: 2.6 to 3.0 mm.

.....*Erythrodiplax ochracea* (Burmeister, 1839) pars
 (Argentina, Paraguay, Bolivia, Bahia, Espirito Santo, São Paulo, Rio de Janeiro, Mato Grosso, Mato Grosso do Sul). Syn: *Libellula ochracea* Burmeister, 1839; *Diplax ochracea* (Burmeister, 1939) Hagen, 1861; *Trithemis ochracea* (Burmeister, 1939) Kirby, 1890; *Libellula distinguenda* Rambur, 1942 (pars).

- The hind wing is 23.5 to 28.5 mm in length (**Fig. 3.2.267**).80
 80. The lateral spot on the seventh segment usually extends dorsal to the dorsal carina. Viewed laterally, the dorsoposterior edge of the vulvar lamina forms an angle of almost 90° with the lateral margin of the ninth segment. The apex of the vulvar lamina is only slightly, if at all, bent caudad. The anal angle of the wing is usually well developed and has four or more rows of post-loop cells (**Fig. 3.2.267**). Length of female abdomen: 20 to 23.5 mm. Hind wing length of female: 23.5 to 28.5 mm. Beyond the dark marking at the wing base, the rest of the wing is hyaline with a blackish pterostigma, 2.4 to 3.7 mm long. The color of the female is variable from largely yellow with dark markings to almost entirely dark.

.....*Erythrodiplax fervida* (Erichson, 1838)
 (Mexico, Central America, West Indies, Colombia, Ecuador, Venezuela, Guyana, French Guiana, Surinam). Syn: *Libellula fervida* Erichson, 1838; *Libellula justina* Selys in Sagra, 1857; *Libellula distinguenda* Rambur, 1942 (pars).

- The lateral spot on the seventh segment usually does not extend dorsal to the dorsal carina. Viewed laterally, the dorsoposterior edge of the vulvar lamina forms an angle of no more than 60° with the lateral margin of the ninth segment. The tip of the vulvar lamina is bent slightly caudad. There are not more than three or four rows of post-loop cells (**Fig. 3.2.257**). Length of female abdomen: 18.5 to 22.5 mm. Hind wing length of female: 23.5 to 28 mm. Length of the pterostigma: 2.6 to 3.1 mm.

.....*Erythrodiplax kimminsi* Borror, 1942
(Costa Rica, Panama, Colombia, Venezuela, Ecuador, Mato Grosso do Sul).
Trithemis erichsoni Kirby, 1994 (pars).

81. The penultimate spine on the outer angle of the hind femur is at least 1/3 as long as the ultimate spine. There are two rows of post-loop cells in the hind wing. In lateral view, the vulvar lamina appears barely one quarter as long as the ninth abdominal segment with its apex directed posteriad (**Fig. 3.2.270**). Length of male abdomen: 24 to 25 mm. Hind wing length of male: 18 to 25 mm. Length of pterostigma: 2.3 to 2.9 mm. The head and ventral part of the thorax are yellowish, and the dorsal part of the thorax and abdomen are reddish brown. The wings are hyaline or with a slight yellow tinge, and the pterostigmas are blackish. The male is darker and becomes bluish gray with age.

.....*Erythrodiplax angustipennis* Borror, 1942
(Peru, Venezuela, Surinam, French Guiana, Bolivia, Mato Grosso).

- The penultimate spine on the outer angle of the hind femur is no more than 1/4 as long as the ultimate spine. There are usually three or more rows of post-loop cells in the hind wing. In lateral view, the vulvar lamina appears large and triangular with its apex directed ventrad; it appears at least 1/3 the length of the ninth abdominal segment (**Fig. 3.2.268**).82

82. The yellow spot on the side of the sixth abdominal segment extends to the dorsal carina and caudad beyond the middle of the segment (**Fig. 3.2.268**). Hind wing length: 20 to 26 mm. Some specimens have hyaline wings, while others have large colored areas covering the middle of the wing. The general coloration is dark brown to black with yellowish lateral markings on the abdomen, which are sometimes obscure. Length of abdomen of female: 18 to 22.5 mm. Hind wing length of female: 20.5 to 26 mm. Length of pterostigma: 1.9 to 3.0 mm.

.....*Erythrodiplax attenuata* (Kirby, 1894)
(Colombia, Ecuador, Peru, Venezuela, Surinam, Bolivia, Pará, Amazonas, Rondônia, Mato Grosso, São Paulo). Syn: *Trithemis attenuata* Kirby, 1894;
Erythrodiplax attenuata forma *hyalina* Sjöstedt, 1918.

- The yellow spot on the side of the sixth abdominal segment does not extend to the dorsal carina and usually does not reach the middle of the segment (**Fig. 3.2.10**). Hind wing length: 23 to 26 mm.

.....*Erythrodiplax venustus* (Kirby, 1897)
(Surinam, Bolivia, Amazonas, Mato Grosso).

83. The basal spots on both wings extend to or nearly to the nodus; its distal part is darker. The vulvar lamina is about half as long as the ninth segment or slightly longer; in profile, it is narrow and rounded at the apex. There is a complete lateral stripe on the abdomen just dorsal to the lateral carina (**Fig. 3.2.283**). Hind wing length: 21.5 to 25 mm.

.....*Erythrodiplax chromoptera* Borror, 1942
(Argentina, Uruguay, Rio Grande do Sul, Paraná, São Paulo, Federal District).

- The basal spots on both wings usually do not extend beyond the triangle; its distal part is lighter (**Fig. 3.2.259**).84

84. The arculus in the fore-wing is at the level of the second antenodal cross vein, and that in the hind wing is slightly proximal to it. The vulvar lamina of the female is longer than half the length of the ninth segment but shorter than the segment (**Fig. 3.2.298**). Length of abdomen including appendices: c. 16 mm. Hind wing length: c. 19 mm. Length of pterostigma: c. 2.5 mm. Color: Labrum ferrugineous; labium and most of face dark ferrugineous, sometimes nearly black in the center of the labium; clypeus with yellow lateral markings; frons and vertex metallic black with a bluish tinge. There are yellow lateral markings on the occiput. The prothorax is light yellow, and the synthorax is yellowish orange to a brighter red than on the male. The legs are dark reddish brown. The wings are hyaline with golden yellow markings at the bases. The pterostigma and membranula are light brown. The abdomen is dark brown with yellow lateral stripes interrupted by darker markings at the articulations. The second and third appendages have red markings dorsally, less prominent than in the male, and the first three segments are yellow ventrally. The anal appendages are dark yellow.

.....*Erythrodiplax gomesi* Santos, 1946
(São Paulo, Paraná).

- The arculus in the fore-wing is clearly proximal or distal to the level of the second antenodal cross vein (**Fig. 3.2.259**).85

85. The arculus in the fore-wing is at the level of the second antenodal; that in the hind wing is between the second and third antenodals. Cu_1 in the hind wing is separated from the anal angle of the triangle. The hind wing is distinctly narrowed basally and has only two rows of post-loop cells (**Fig. 3.2.259**). Length of female abdomen: c. 23 mm. Pterostigma length: 2.2 to 2.6 mm. Hind wing length of female: 19 to 21.5 mm. The thorax of the female is light reddish brown on the dorsum and yellow with small reddish brown markings. The abdomen of the female is ochraceous proximally and becomes increasingly blackened toward the apex.

.....*Erythrodiplax anatoidea* Borror, 1942
(Rondônia).

- The arculus in the fore and hind wings is at the level between the first and second antenodal. The hind wing is not distinctly narrowed basally and has three or more rows of post-loop cells (**Fig. 3.2.277**).86

86. In lateral view, the vulvar lamina is somewhat triangular, and its dorsoposterior margin is nearly straight (**Fig. 3.2.273**).87

- In lateral view, the vulvar lamina is not generally triangular, and its dorsoposterior margin is convex (**Fig. 3.2.296**).89
 87. In lateral view, the vulvar lamina is less than half as wide at the base as long. The thorax often has black and yellow stripes. There is only one row of cells between R_s and M_2 . There are 4 to 7 marginal cells in the discoidal field of the fore-wing (**Fig. 3.2.273**). Hind wing length of female: 23 to 27 mm. The male is usually much darker than the female. The wings of some specimens may be clouded in places with amber.

.....*Erythrodiplax naeva* (Hagen, 1861) pars
 (Central America, West Indies, Colombia, Venezuela). Syn: *Dythemis naeva* Hagen, 1861. *Erythrodiplax naeva* (Hagen, 1861) has been treated as a subspecies of the North American species, *Erythrodiplax berenice* (Drury, 1773), from which it is distinguished by its 4 to 7 marginal cells in the discoidal field, its pterostigma shorter than 3 mm, and its range, which encompasses Central and South America and some of the West Indies. *Erythrodiplax berenice* has a pterostigma on the fore-wing 3 mm or more in length and 6 to 10 marginal cells in the discoidal field. Synonyms of one or both subspecies include *Libellula berenice* Drury, 1773; *Diplax berenice* (Drury, 1773), *Libellula histrio* Burmeister, 1839; *Dythemis naeva* Hagen, 1861. In this key, *Erythrodiplax naeva* is treated as a distinct species, but some specimens of *E. berenice* will also key out here. Dunson (1980) referred to *E. berenice* as a marine dragonfly, which tolerates the full salinity of seawater.

- In lateral view, the vulvar lamina is more than half as wide at the base as long. The thorax lacks black and yellow stripes but may have a narrow brown antehumeral stripe (**Fig. 3.2.277**).88
 88. There is no distinct antehumeral stripe on the thorax. The lateral longitudinal stripe on the sixth and seventh segments are rather poorly defined and usually interrupted on the anterior half of each segment (**Fig. 3.2.277**). Length of hind wing: 21.5 to 24 mm.

.....*Erythrodiplax juliana* (Ris, 1911)
 (Colombia, Peru, Venezuela, Bolivia, Amazonas, Minas Gerais, Espirito Santo, São Paulo).

- There is a narrow brown antehumeral stripe on the thorax. The lateral longitudinal stripe on the sixth and seventh segments are well defined and usually complete (**Fig. 3.2.279**). Length of hind wing: 21.5 to 27 mm.

.....*Erythrodiplax hyalina* (Förster, 1907)
 (Paraguay, Uruguay, São Paulo, Santa Catarina, Rio Grande do Sul).

89. Cu_1 in the hind wing is usually separated from the anal angle of the triangle. There is no dark antehumeral stripe on the thorax. The last antenodal in the fore-wing may sometimes be complete (**Fig. 3.2.272**). Hind wing length: 15 to 26 mm.90

- Cu_1 in the hind wing usually arises from the anal angle of the triangle or is only slightly separated from it. There is usually a dark antehumeral stripe on the thorax. The last antenodal in the fore-wing is usually incomplete (**Fig. 3.2.285**). Hind wing length: 20 to 31.5 mm.98

90. The vulvar lamina is as long or slightly longer than the ninth segment and is sharply pointed at the apex in lateral view (**Fig. 3.2.296**).91
 - The vulvar lamina is shorter than the ninth segment and usually more or less rounded in lateral view (**Fig. 3.2.278**).94
 91. The hind wing is 26 mm long (**Fig. 3.2.296**).
*Erythrodiplax nivea* Borror, 1942
 (São Paulo).
 - The hind wing is 17.5 to 23 mm long (**Fig. 3.2.272**).92
 92. There is no clouding at the base of the wing, but there is a large dark brown mark that runs from a point just beyond the proximal border of the pterostigma to the apex and from the anterior to the posterior margin of each wing (**Fig. 3.2.272**). The head of the female is orange to brown orange. The thorax has obscure and poorly defined lighter areas on a dark reddish brown background. The abdomen of the female is uniformly reddish with narrow blackish borders on some of the segments. Length of female abdomen: 15.5 to 16 mm. Hind wing length of female: 20 to 21 mm. Length of pterostigma: c. 3 mm.
*Erythrodiplax lygaea* Ris, 1911
 (Argentina, São Paulo).
 - There is clouding at the wing base and no prominent dark marking at the apex (**Fig. 3.2.281**). The head, thorax, and abdomen are dull ochraceous with some brownish areas, including the dark ventral surface of the abdomen and the dorsal sides of the sixth through eighth abdominal segments. Hind wing length: 17.5 to 23 mm.93
 93. There are distinct yellow spots ventral to the antennae and adjacent to the compound eyes (**Fig. 3.2.281**).
*Erythrodiplax basalis* (Kirby, 1897)
 (West Indies, Colombia, Venezuela, Peru, Ecuador, Guyana, French Guiana, Rondônia, Amazonas, Pará, Mato Grosso, Mato Grosso do Sul, São Paulo, Rio de Janeiro). Syn: *Micrathyria basalis* Kirby, 1897; some references to *Trithemis basifusca* Calvert, 1895; probably *Libellula erratica* Erichson, 1848; *Erythrodiplax basalis basalis* (Kirby, 1897).
 - There are no distinct yellow spots ventral to the antennae and adjacent to the compound eyes.
*Erythrodiplax avittata* Borror, 1942
 (Surinam, Bolivia, Paraguay, Argentina, Bahia, São Paulo, Rio de Janeiro, and Mato Grosso). Syn: *Erythrodiplax basalis avittata* Borror, 1942.
 94. The penultimate spine at the outer angle of the hind femur is not more than 1/3 of the length of the ultimate spine. Each of the wings often has a brown or gray spot behind the stigma. The vulvar lamina is more than half as wide at its base as long, as seen in lateral view (**Fig. 3.2.278**). Hind wing length: 22 to 24.5 mm. The head and thorax of the female are light olive green, and the abdomen is brownish yellow with blackish dorsal and lateral markings. The apical segments may be somewhat reddish.
*Erythrodiplax nigricans* (Rambur, 1842)
 (Argentina, Uruguay, Paraguay, Rio Grande do Sul, Rio de Janeiro).

- The penultimate spine at the outer angle of the hind femur is about half the length of the ultimate spine. The wings never have brown or gray spots behind the stigma. The vulvar lamina is less than half as wide at its base as long, as seen in lateral view (**Fig. 3.2.293**).95

95. The last antenodal cross vein in the fore-wing is complete. The labrum, clypeus, and a spot on each side of the frons below the antenna are yellow (**Fig. 3.2.293**). Length of female abdomen: 14.5 to 16.5 mm. Hind wing length of female: 17.5 to 18 mm. In both sexes, the frons is blackish with a pair of bright blue markings. The thorax of the female is light reddish brown to yellow, and the female abdomen is dark brown with large brownish yellow lateral markings. The wings are hyaline or have a slight yellow tinge, brownish and yellowish veins, and brown pterostigmas, which are 2.1 to 2.4 mm long.

.....*Erythrodiplax tenuis* Borror, 1942
(Ecuador, Peru, Rondônia, São Paulo).

- The last antenodal cross vein in the fore-wing is usually incomplete (**Fig. 3.2.294**). As the dragonfly matures, the entire face becomes brownish black or bluish black. Hind wing length: 15 to 24.5 mm.96

96. The dorsal surface of the superior anal appendage forms nearly a straight line (**Fig. 3.2.294**). Length of female abdomen: 17 to 20.5 mm. Hind wing length of female: 20 to 24.5 mm. Pterostigma length: 2.4 to 3.3 mm.

.....*Erythrodiplax andagoya* Borror, 1942
(Colombia, Ecuador).

- The dorsal surface of the superior anal appendage is convex toward the apex (**Fig. 3.2.285**). Hind wing length: 15 to 24 mm.97

97. The hind wing is 20 to 24 mm long. The triangle in the fore-wing is usually crossed (**Fig. 3.2.285**).

.....*Erythrodiplax media* Borror, 1942
(Bolivia, Paraguay, Argentina, Espírito Santo, Minas Gerais, São Paulo, Santa Catarina, Rio Grande do Sul).

- The hind wing is 15 to 20 mm long. The triangle in the fore-wing is usually free (**Fig. 3.2.295**). The female is lighter in color than the male, with yellow on the head, thorax, and abdomen. There are brown dorsal and lateral markings on the abdomen. The wings are hyaline. The pterostigma is cloudy light gray with darker borders.

.....*Erythrodiplax paraguayensis* (Förster, 1904)
(Argentina, Paraguay, Guyana, Surinam, Bolivia, Venezuela, Minas Gerais, São Paulo, Rio Grande do Sul, Mato Grosso, Mato Grosso do Sul). The females of this species resemble *E. minuscula* (Rambur, 1842), a North American subspecies of a widespread species.

98. The remaining females in the key cannot be unequivocally distinguished, and range information was used by Borror (1942) to help distinguish them. The basal spot on the hind wing usually extends at least as far as the base of the triangle (**Fig. 3.2.286**). Hind wing length: 27 to 31.5 mm.

.....*Erythrodiplax ines* (Ris, 1911)
(Ecuador, Peru, Bolivia, at elevations above 1000 m).

- The basal spot on the hind wing does not extend beyond the base of the triangle (**Fig. 3.2.290**), or, if it does, then the hind wing length does not exceed 25.5 mm.99

99. Presently only the range is an indication of the identity of female specimens of the following species. It occurs on the Pacific Coast of Peru and northern Chile. Hind wing length: 21.5 to 25.5 mm. The female has small amber markings at the bases of the otherwise hyaline wings. The pterostigma is brownish (**Fig. 3.2.290**). The head and thorax are brown, and the abdomen is blackish with large dorsal reddish brown patches on the segments and yellowish brown anal appendages. The legs are yellowish brown with black markings on the femora and tibiae and black tarsi.

.....*Erythrodiplax cleopatra* (Ris, 1911)
(Peru, Chile).

- Range elsewhere. Hind wing length: 19 to 31.5 mm.100
100. The wing tips are brown or black as far proximad as the middle of the stigma or more. At least in the male, the stigma is the same color as the marking. (**Fig. 3.2.280**). Hind wing length: 20 to 25.5 mm. The male is a uniform dark reddish brown, slightly darker on the dorsal surface of the thorax.

.....*Erythrodiplax atroterminata* (Ris, 1911)
(Argentina, Paraguay, Uruguay, São Paulo, Santa Catarina, Rio Grande do Sul).

- The membrane is hyaline at the apices of the wings.101
101. The vulvar lamina is as long as the ninth segment or longer (**Fig. 3.2.289**). The species often, but not always, occur at elevations above 1000 m.102

- The vulvar lamina is shorter than the ninth segment (**Fig. 3.2.282**).103
102. Hind wing length: 22 to 27 mm (**Fig. 3.2.289**).

.....*Erythrodiplax melanorubra* Borrer, 1942
(Venezuela, Colombia, Ecuador, Peru, Argentina, Bolivia, Paraguay, São Paulo).

- Hind wing length: 25 to 29 mm (**Fig. 3.2.292**). The species occurs at elevations above 1000 m. The general coloration is dark, with an abdomen that is blackish in the male and dark brown in the female. The thorax of the male is usually dark brown, and that of the female is orange with an olive green tinge.

.....*Erythrodiplax abjecta* (Rambur, 1844)
(Mexico, Central America, West Indies, Colombia, Ecuador, Venezuela, Mato Grosso, Mato Grosso do Sul). Syn: *Libellula connata abjecta* Rambur, 1842; *Erythrodiplax ponderosa* Karsch, 1891.

103. No way has been reported to distinguish all females of the remaining three species morphologically. They are tentatively grouped according to range information. One species has a range encompassing those of the other two. See **Fig. 3.2.288**.

.....*Erythrodiplax connata* (Burmeister, 1839)
(North and Central America, West Indies, Colombia, Venezuela, Guyana, French Guiana, Ecuador, Peru, Uruguay, Argentina, Chile, Paraguay, Bolivia, Amazonas, Pará, Rondônia, Rio Grande do Norte, Bahia, Espírito Santo, Minas Gerais, São Paulo, Rio de Janeiro, Santa Catarina, Rio Grande do Sul, Mato Grosso).

- Two species with much more limited ranges.104
- 104. Range apparently confined to Venezuela. See **Figure 3.2.282.**
.....*Erythrodiplax clitella* Borror, 1942
(Venezuela). The reference to Chile seems to be a mistake (Borror, 1942).
- Range apparently confined to south of Amazonia. See **Figure 3.2.285.**
.....*Erythrodiplax media* Borror, 1942
(Bolivia, Paraguay, Argentina, Espirito Santo, Minas Gerais, São Paulo, Santa Catarina, Rio Grande do Sul).

Key to the species of known *Erythrodiplax* larvae in South America

Information for the key was provided by Limongi (1990), DeMarmels (1992), and Costa *et al.* (2001). The larvae of few species have been described.

1. There are 10 to 12 long setae on each labial palp and usually 13 to 18 premental setae (**Fig. 3.2.300**).2
- There are 6 to 9 long setae on each labial palp and usually 9 to 12, but occasionally 13 premental setae (**Fig. 3.2.301**).3

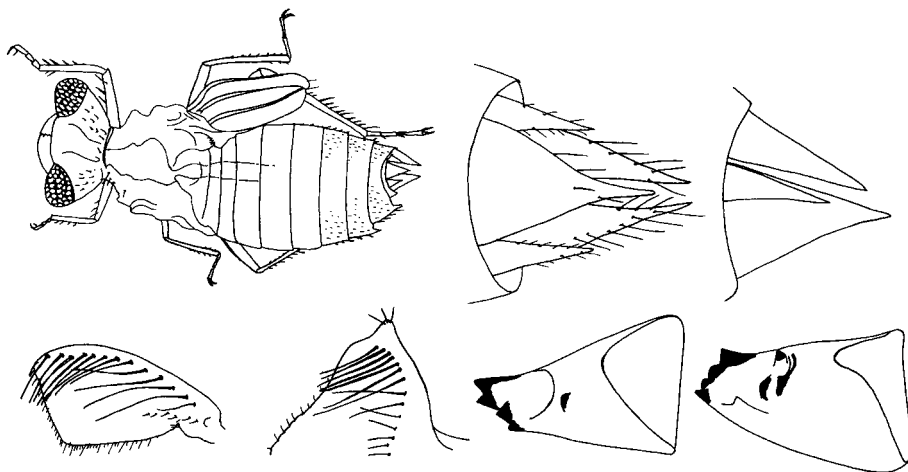


Fig. 3.2.300 *Erythrodiplax umbrata* male larva (above, left to right): habitus from an exuvia, caudal appendages in dorsal and lateral view, and (below, left to right): labial palp, right half of the labium without the palp in dorsal view, left and right mandible. Based on Costa *et al.* (2001).

2. The length of the epiproct is clearly greater than its width at the base. The tibiae are fringed with setae only slightly longer than the width of the tibia.

There are usually 13 to 15 premental setae (**Fig. 3.2.300**). Maximum length of the larva: 19 mm.

.....*Erythrodiplax umbrata* (Linnaeus, 1758)
(North America, Central America, West Indies, Colombia, Guyana, French Guiana, Surinam, Venezuela, Peru, Ecuador, Paraguay, Bolivia, Uruguay, Argentina, Amazonas, Rondônia, Espírito Santo, Pará, Mato Grosso, Mato Grosso do Sul, Rio de Janeiro, São Paulo, Rio Grande do Sul). Syn: *Libellula umbrata* Linnaeus, 1758; *Libellula unifasciata* DeGeer, 1773; *Libellula fallax* Burmeister, 1839; *Libellula ruralis* Burmeister, 1839; *Libellula subfasciata* Burmeister, 1839; *Libellula tripartita* Burmeister, 1839; *Libellula flavicans* Rambur, 1842; *Libellula fuscofasciata* Blanchard, 1845; *Trithemis umbrata* (Linnaeus, 1758); *Trithemis montezuma* Calvert, 1899.

- The width at the base of the epiproct is greater than its length. There are about 18 premental setae in the row on each side of the prementum. There are fringes of short setae on both the internal and external margins of the labial palps. The setae on the tibiae are at least twice the width of the tibia, and those on the hind tibiae are much greater than twice the width (**Fig. 3.2.302**).

.....*Erythrodiplax amazonica* Sjostedt, 1918
(Trinidad, Guyana, French Guiana, Peru, Venezuela, Amazonas, Pará, Rondônia). Syn: *Erythrodiplax lenti* Ris, 1919.

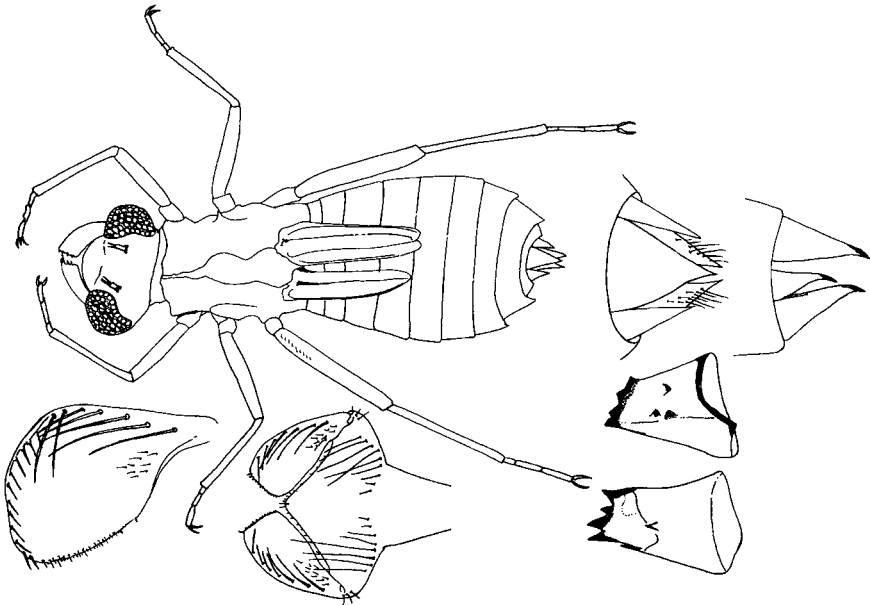


Fig. 3.2.301 *Erythrodiplax pallida* male larva (above, left to right): habitus from an exuvia, caudal appendages in dorsal and lateral view, and (below, left to right): labial palp, labium in dorsal view, and mandibles. Based on Costa *et al.* (2001).

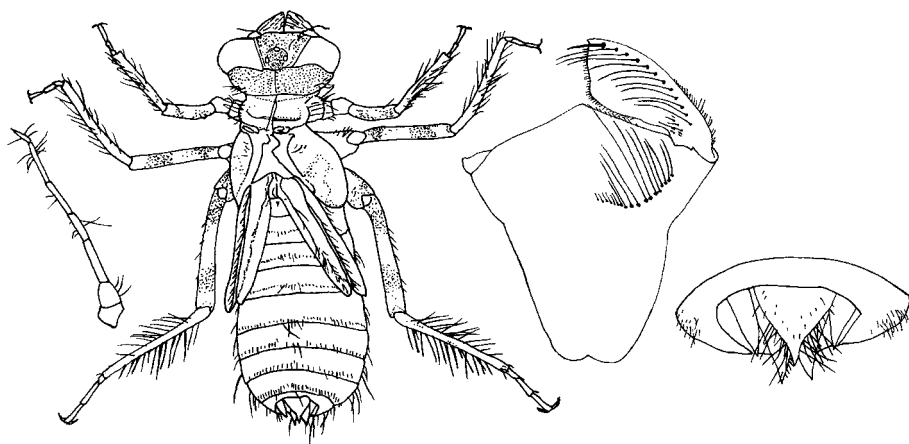


Fig. 3.2.302 *Erythrodiplax amazonica* larva (left to right): antenna, habitus, labium in dorsal view showing only the right palp, and apex of the abdomen in dorsal view. Based on DeMarmels (1992).

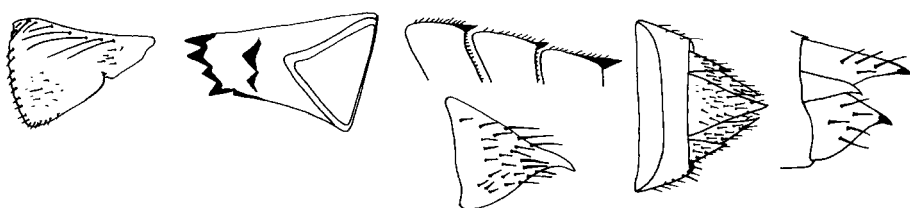


Fig. 3.2.303 *Erythrodiplax lygaea* male larva (left to right): labial palp, left mandible, lateral spines on the right side of the seventh through ninth abdominal segments (above), epiproct (below), and apex of the abdomen in dorsal and lateral view. Based on Costa *et al.* (2001).

3. There are nine premental setae on the labium. The lateral spine on the ninth abdominal segment does not exceed half the length of the cerci. Three spines are located at the articulation of the labial palp and prementum. The labial palp has six palpal setae (**Fig. 3.2.301**).

.....*Erythrodiplax pallida* (Needham, 1904)
(São Paulo). Syn: *Micrathyria pallida* Needham, 1904.

- There are 10 to 13 premental setae (**Fig. 3.2.303**).4
- 4. Lateral spines are present on the seventh through ninth abdominal segments (**Fig. 3.2.303**).5
- Lateral spines are present only on the eighth and ninth abdominal segments (**Fig. 3.2.304**).6

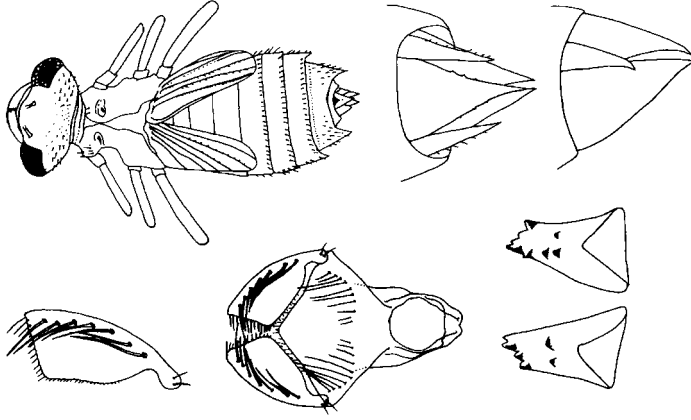


Fig. 3.2.304 *Erythrodiplax latimaculata* male larva (above, left to right): habitus from an exuvia, caudal appendages in dorsal and lateral view, and (below, left to right): labial palp, labium in dorsal view, and mandibles. Based on Costa *et al.* (2001).

5. The lateral spines on the seventh through ninth abdominal segments are almost equal in size. The caudal appendages are only slightly curved ventrad (**Fig. 3.2.303**). Length of abdomen: 16 to 18 mm. Hind wing length: c. 21 mm. Length of pterostigma: c. 3.0 mm.

.....*Erythrodiplax lygaea* Ris, 1911
(Argentina, São Paulo).

- The lateral spines on the seventh abdominal segment are considerably smaller than those on the eighth and ninth. The caudal appendages are strongly curved ventrad (**Fig. 3.2.305**).

.....*Erythrodiplax anomala* (Brauer, 1865)
(Argentina, Rio de Janeiro, São Paulo). Syn: *Libellula (Diplax) anomala* Brauer, 1865.

6. The labial palp bears a small seta, eight palpal setae, and four setae on its external margin. The cerci are smaller than the epiproct, and both are smaller than the paraproct (**Fig. 3.2.306**).

.....*Erythrodiplax juliana* (Ris, 1911)
(Colombia, Peru, Venezuela, Bolivia, Amazonas, Minas Gerais, Espírito Santo, São Paulo).

- The external margin of the labial palp is free of setae (**Fig. 3.2.303**).7

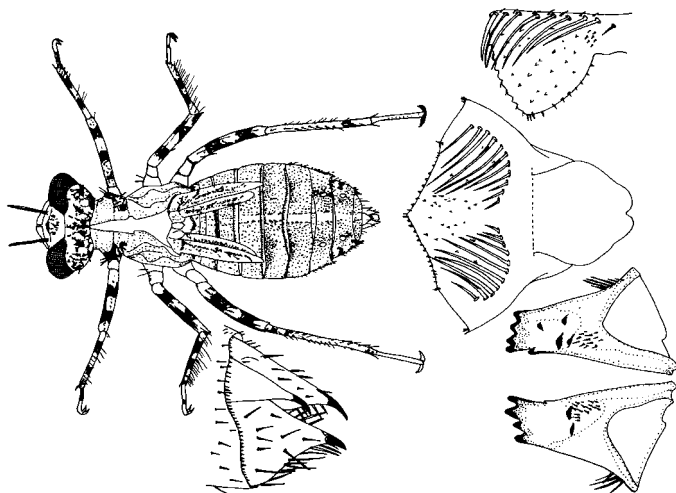


Fig. 3.2.305 *Erythrodiplax anomala* larva: habitus from exuvia (left), labium without the palps (middle right), labial palp (upper right), mandibles (lower right), and caudal appendages in lateral view (lower center). Based on Carvalho *et al.* (1991).

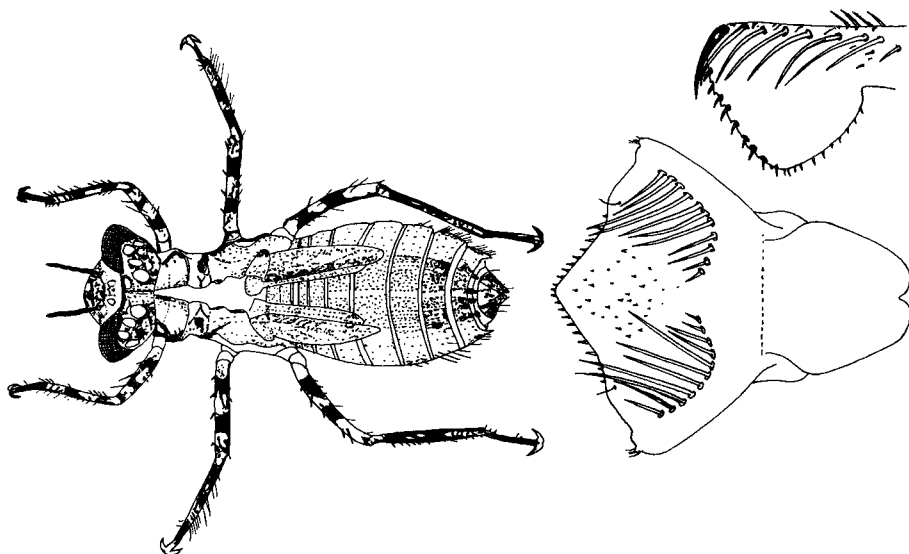


Fig. 3.2.306 *Erythrodiplax juliana* larva: habitus from exuvia (left), labium without the palps (lower right), and the labial palp (upper right). Based on Carvalho *et al.* (1991).

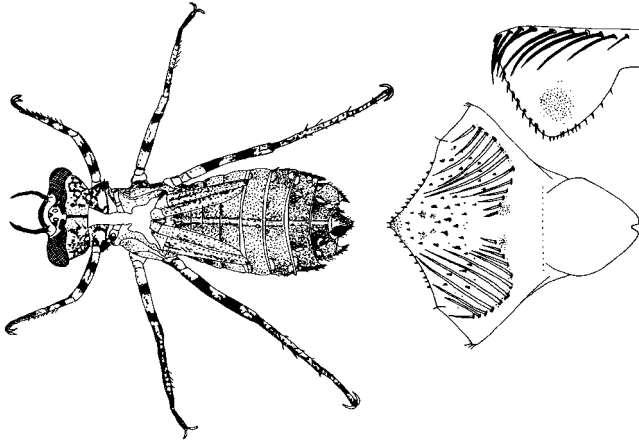


Fig. 3.2.307 *Erythrodiplax ochracea* larva: habitus from exuvia (left), labium without the palps (lower right), and the labial palp (upper right). Based on Carvalho *et al.* (1991).

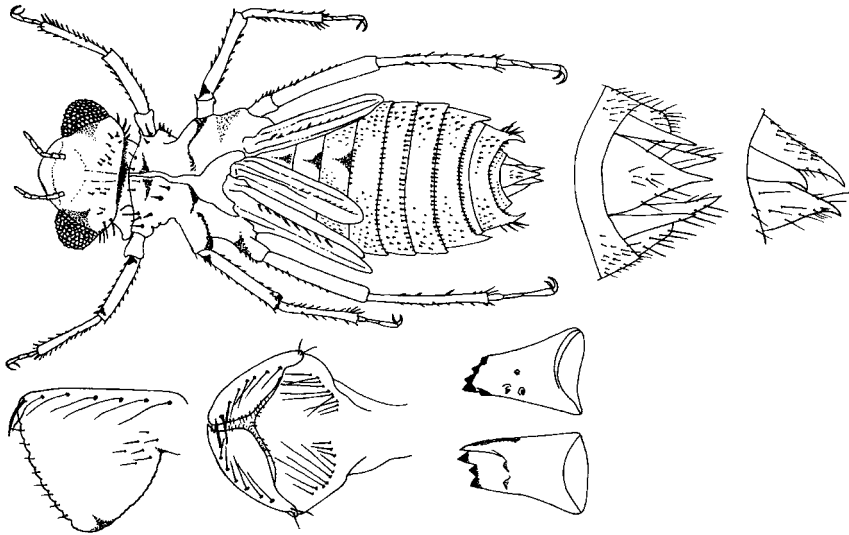


Fig. 3.2.308 *Erythrodiplax basalis* male larva (above, left to right): habitus from an exuvia, caudal appendages in dorsal and lateral view, and (below, left to right): labial palp, labium in dorsal view, and mandibles. Based on Costa *et al.* (2001).

7. The lateral spines on the ninth abdominal segment are well developed and reach the distal end of the cerci. There are one or two crenulated spines on the labial palp, and two spines at the articulation of the labial palp with the prementum (**Fig. 3.2.304**). Male chromosome number: $2n = 25$, $n = 13$ (Ferreira *et al.*, 1979).

.....*Erythrodiplax latimaculata* Ris, 1911
(Venezuela, Guyana, Argentina, Bolivia, Minas Gerais, Bahia, Rio de Janeiro, São Paulo, Amazonas, Mato Grosso).

- The spines on the ninth abdominal segment are short and do not reach as far posteriad as the distal end of the cerci (**Fig. 3.2.307**).8

8. There are eight or nine palpal setae on the labial palp (**Fig. 3.2.307**).9

- There are six or seven palpal setae on the labial palp (**Fig. 3.2.308**).10

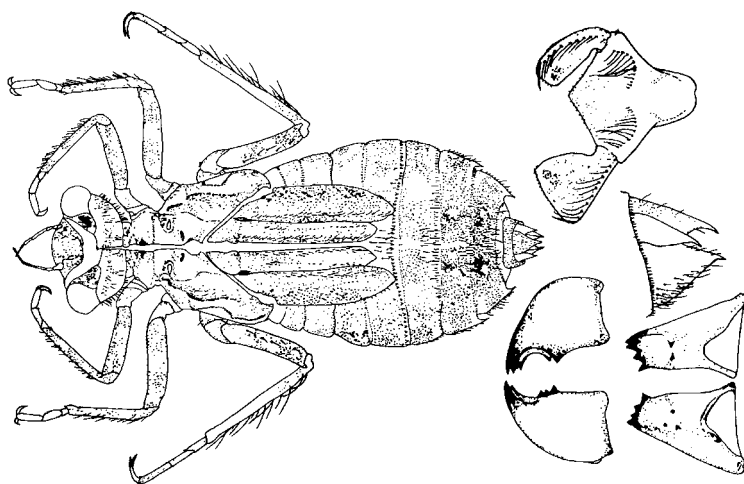


Fig. 3.2.309 *Erythrodiplax nigricans* larva (left to right): habitus from exuvia (left), labium in dorsal view (upper right), apex of the abdomen in lateral view (middle right) and mandibles in posterior (lower right center) and interior view (lower right). Based on von Ellenrieder and Muzón (2000).

9. The cerci do not extend beyond the middle of the epiproct. There are two spines at the articulation of the labial palp with the prementum (**Fig. 3.2.307**). Length of abdomen: 16.5 to 18 mm. Hind wing length: 20 to 23 mm. Length of pterostigma: 2.6 to 3.0 mm.

.....*Erythrodiplax ochracea* (Burmeister, 1839) pars
(Trinidad, Colombia, Peru, Guyana, French Guiana, Surinam, Argentina, Paraguay, Bolivia, Bahia, Espírito Santo, São Paulo, Rio de Janeiro, Mato Grosso, Mato Grosso do Sul). Syn: *Libellula ochracea* Burmeister, 1839; *Diplax ochracea* (Burmeister, 1939) Hagen, 1861; *Trithemis ochracea* (Burmeister, 1939) Kirby, 1890; *Libellula distinguenda* Rambur, 1942 (pars).

- The cerci extend beyond the middle of the epiproct. There are three spines at the articulation of the labial palp with the prementum (**Fig. 3.2.309**).

.....*Erythrodiplax nigricans* (Rambur 1842)
(Argentina, Uruguay, Paraguay, Rio Grande do Sul, Rio de Janeiro, Minas Gerais). Syn: *Libellula vilis* Rambur, 1842; *Erythrodiplax chloropleura* (Brauer) Ris, 1904.

10. There are six palpal setae on the labial palp (**Fig. 3.2.308**).

.....*Erythrodiplax basalis* (Kirby, 1897)
(West Indies, Colombia, Venezuela, Peru, Ecuador, Guyana, French Guiana, Surinam, Bolivia, Paraguay, Argentina, Rondônia, Amazonas, Pará, Mato Grosso, Mato Grosso do Sul, São Paulo, Rio de Janeiro). Syn: *Microthyria basalis* Kirby, 1897; some references to *Trithemis basifusca* Calvert, 1895; probably *Libellula erratica* Erichson, 1848.

- There are seven palpal setae on the labial palp (**Fig. 3.2.310**). 11

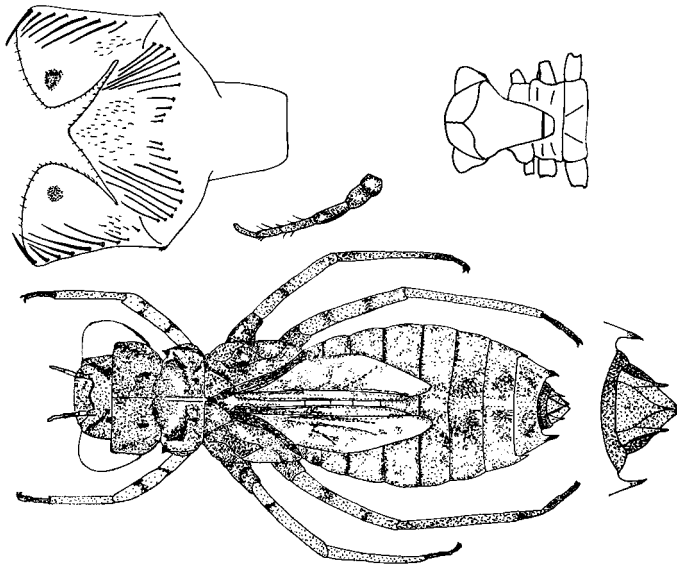


Fig. 3.2.310 *Erythrodiplax melanorubra* larva: habitus (lower left), labium (upper left), antenna (upper center), head and thorax in ventral view (upper right), and the caudal appendages in dorsal view (lower right). Based on Limongi (1990) and Costa *et al.* (2001).

11. There are two spines at the articulation of the labial palp with the prementum, and there are 11 premental setae on each side (**Fig. 3.2.310**).

.....*Erythrodiplax melanorubra* Borror, 1942
(Venezuela, Colombia, Ecuador, Peru, Chile, Argentina, Bolivia, Paraguay, São Paulo).

- There are three spines at the articulation of the labial palp with the prementum, and there are 10 premental setae on each side (**Fig. 3.2.118**). Male chromosome number: $2n = 25$, $n = 13$ (Ferreira *et al.*, 1979).

.....*Erythrodiplax fusca* (Rambur, 1842)
(North and Central America, West Indies, Colombia, Ecuador, Peru, Venezuela, Guyana, French Guiana, Surinam, Bolivia, Paraguay, Uruguay, Argentina, Amazonas, Pará, Rondônia, Rio Grande do Norte, Bahia, Espírito Santo, Minas Gerais, São Paulo, Rio de Janeiro, Santa Catarina, Rio Grande do Sul, Mato Grosso, Mato Grosso do Sul). Syn: *Libellula fusca* Rambur, 1842; *Libellula incompta* Rambur, 1842; *Erythrodiplax connata fusca* (Rambur, 1842).

Key to the species of adult *Elga* in South America

Information for the key was provided by Machado (1954a, 1992). The names were incorrectly applied to these two species in the literature prior to 1992. A key to the larvae cannot yet be provided.

1. The synthorax of the male has three large, greenish black markings; that of the female is blackish with three light green markings. The posterior lobe of the prothorax is bordered in white. The tarsal claws lack or have very small subapical teeth. The last antenodal cross vein is incomplete; the female usually has $8\frac{1}{2}$ or $9\frac{1}{2}$ antenodal cross veins in the fore-wing and 7 in the hind wing (**Fig. 3.2.90**). The fourth through seventh abdominal segments each have one light anterior marking. In lateral view, the ventral margin of the superior anal appendage of the male is sigmoid. Length of abdomen: 18 to 20 mm. Hind wing length: 22 to 23 mm. Length of pterostigma: c. 2.0 mm. The membrane on the basal half of the wing is tinged amber, while the apical half is hyaline with a black pterostigma. The legs are black with small brownish areas at the bases of the femora. Found near streams in open forest.

.....*Elga leptostyla* Ris, 1911
(Central America, Colombia, Ecuador, Peru, Venezuela, Guyana, French Guiana, Surinam, Mato Grosso, Minas Gerais, Goiás, São Paulo). Syn: *Elga santosi* Machado, 1954.

- The synthorax of the male lacks large, greenish black markings; that of the female is generally yellow with greenish markings. The posterior lobe of the prothorax has a greenish yellow border. There is a well-developed subapical tooth on each tarsal claw. The last antenodal cross vein is complete; the female has 11 or 12 antenodal cross veins in the fore-wing and 9 in the hind wing. The fourth through seventh abdominal segments of the male each have pale markings occupying the entire basal $1/6$ to $1/5$ of the segment, while those of the female have yellow stripes occupying almost the entire segment length. The ventral margin of the male superior anal appendage appears evenly arched so that the apex curves ventrad in lateral view (**Fig. 3.2.311**). Length of male abdomen

without appendages: 18.5 to 20 mm; female: c. 21 mm. Hind wing length of male: 19 to 21 mm; female: c. 22 mm. Pterostigma length: c. 2.1 mm.

.....*Elga newtonsantosi* Machado, 1992
(São Paulo). Syn: *Elga leptostyla* nec Ris, 1911, sensu Machado (1954a).

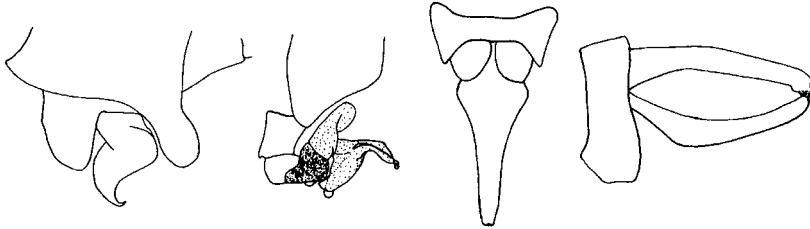


Fig. 3.2.311 *Elga newtonsantosi* male (left to right): genitalia on the second abdominal segment in lateral view, penis in lateral view, inferior anal appendage in ventral view, and apex of the abdomen in lateral view. Based on Machado (1954a), illustrated under the name *Elga leptostyla*.

Key to the species of adult *Oligoclada* in South America

Information for the key was provided by Williamson (1923a), Borrer (1931), Calvert (1948b), Santos (1945d, e; 1946e; 1951), Machado (1954b), Geijskes (1984), DeMarmels (1989a, 1992), and Rehn (2003). Few larvae in this genus have been described, so it is not yet possible to provide even a tentative key to the species for larvae.

1. At about the midlength of the superior anal appendage of the male, there is one prominent, blunt ventral tooth, proximal to which the appendage is strongly arched and bears three smaller teeth. There is a large yellow patch on the ventral half of the mesepisternum of both sexes. The synthorax is black with distinct areas of pruinosity (**Fig. 3.2.312**). The abdomen of the male, including the appendages, is mainly black with pruinose areas on the basal third of the first two segments and dark brown on the apical part of the ninth segment and the apical half of the superior anal appendage. The abdomen of the female has lighter markings, including yellow on the entire dorsal surfaces of the second and third segments, yellowish brown on much of segment 4 dorsal to the lateral carina, and brown bands on the fifth through seventh segments. Total length: c. 25 mm. Length of abdomen: 16 to 17 mm. Hind wing length: 21 to 21.5 mm.

.....*Oligoclada teretidentis* Rehn, 2003
(Ecuador).

- If a single large tooth is prominent on the ventral surface of the superior anal appendage, it is located in the distal half, sharply pointed rather than blunt, and the proximal part of the appendage is not strongly arched (**Fig. 3.2.313**). Any large pale patches on the mesepisterna of the males are dull grayish.2

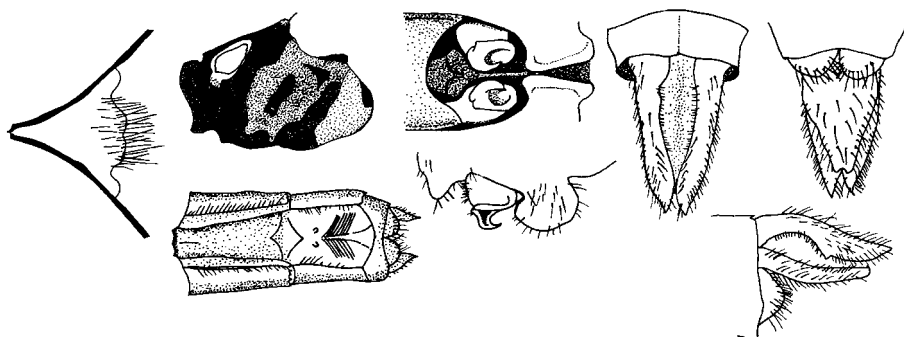


Fig. 3.2.312 *Oligoclada teretidentis* (above, left to right): dorsal view of occiput of a female; synthorax of a male in lateral view, showing the yellow area surrounded by brown as unshaded and the black pruinose areas as stippled; male genitalia on the second abdominal segment in ventral view; apex of the male abdomen in dorsal and ventral view; and (below, left to right): apical segments of a female abdomen in ventral view; male genitalia in lateral view; apex of the male abdomen in lateral view. Based on Rehn (2003).

2. In the fore-wing, the subtriangle and triangle are both free (**Fig. 3.2.313**). There is no transverse carina on the fourth segment of the male abdomen, or only a vestige of one is evident.3
 - In the fore-wing, the subtriangle is divided into three cells, and the triangle is sometimes also crossed (**Fig. 3.2.89**). There is a distinct, well developed transverse carina on the fourth segment of the male abdomen. The last antenodal cross vein in the fore-wing is always incomplete.16
3. There is one row of cells for a distance of at least four cells followed by a double row in the post trigonal space (**Fig. 3.2.313**), that is, the space running distad from the outer margin of the triangle between M_4 and Cu_1 , using the nomenclature in **Fig. 3.2.1**, and between MA and Cu_2 , using that in **Fig. 3.2.2**.4
 - There are two rows of cells for a distance of at least four cells followed by a triple row in the post trigonal space (**Fig. 3.2.314**).5
4. The hind wing is 16.0 to 16.2 mm long, and a length greater than about 16.5 mm should not be expected. The length of the pterostigma of the male is 1.3 to 1.5 mm. There are no distinct teeth on the ventral side of the superior anal appendage. Two yellow spots are situated on the posterior margin of the male occiput. The frons is metallic blue on the upper half and yellow below. There are five or six postnodal cross veins in the fore-wing (**Fig. 3.2.313**). Length of male

abdomen: 13.0 to 13.6 mm. Hind wing length of male: 16.0 to 16.2 mm. Dimensions of females are not available.

.....*Oligoclada sylvia* (Kirby, 1899)
(Peru, Venezuela, Guyana, Surinam, Amazonas, Ceara). Syn: *Nannothemis sylvia* Kirby, 1899.

- The hind wing is 18.2 to 19.9 mm, and a length less than 17.5 mm should not be expected. The length of the pterostigma of the male is 1.6 to 1.9 mm. There are distinct teeth on the ventral side of the superior anal appendage. The male occiput is a uniform blackish brown. The frons is mainly metallic blue with only a brownish ventral margin. There are seven or eight postnodal cross veins in the fore-wing (**Fig. 3.2.315**). Length of abdomen: 15.0 to 15.5 mm. The thorax of the male is metallic black with a bluish tinge and three gray, pruinose stripes. The female has the same pattern but the ground color is metallic reddish brown and the stripes are yellow. Male chromosome number: $2n = 23$, $n = 12$ (Ferreira *et al.*, 1979).

.....*Oligoclada monosticha* Borrer, 1931
(Ecuador, Peru, Venezuela).

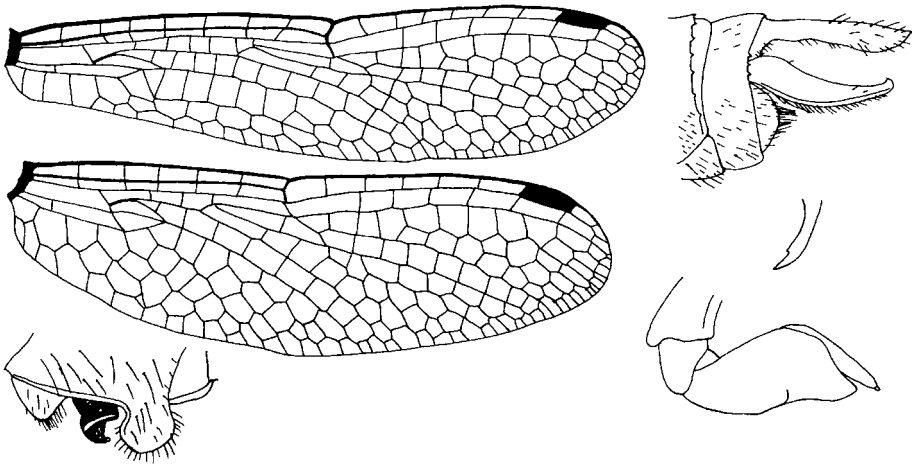


Fig. 3.2.313 *Oligoclada sylvia* male: fore and hind wing (upper left), genitalia on the second abdominal segment in lateral view (lower left), penis in lateral view (lower right), apex of the abdomen in lateral view (upper right), and tarsal claw (middle right). Based on Borrer (1931).

5. There is only a single row of cells beyond the loop in the hind wing (**Fig. 3.2.314**).6
- There are two or more rows of cells beyond the loop in the hind wing (**Fig. 3.2.316**).8

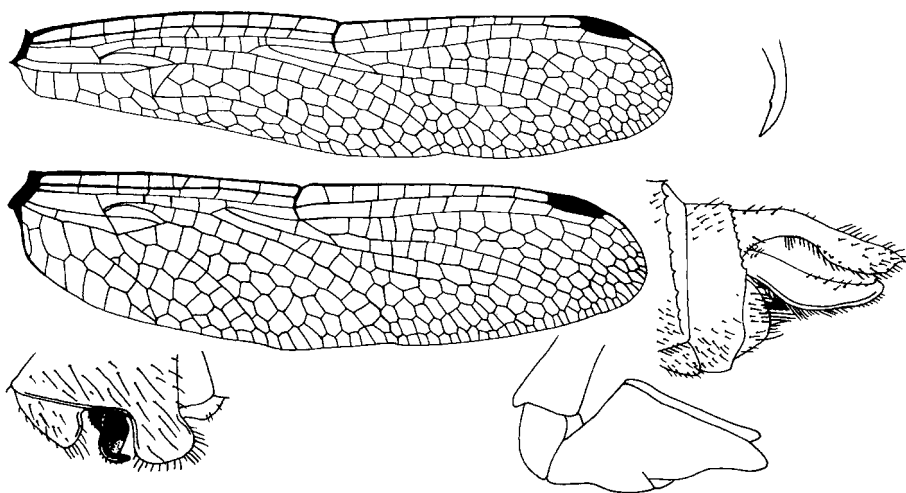


Fig. 3.2.314 *Oligoclada stenoptera* male: fore and hind wing (upper left), tarsal claw (upper right), genitalia on the second abdominal segment in lateral view (lower left), penis in lateral view (lower right), and apex of the abdomen in lateral view (middle right). Based on Borror (1931).

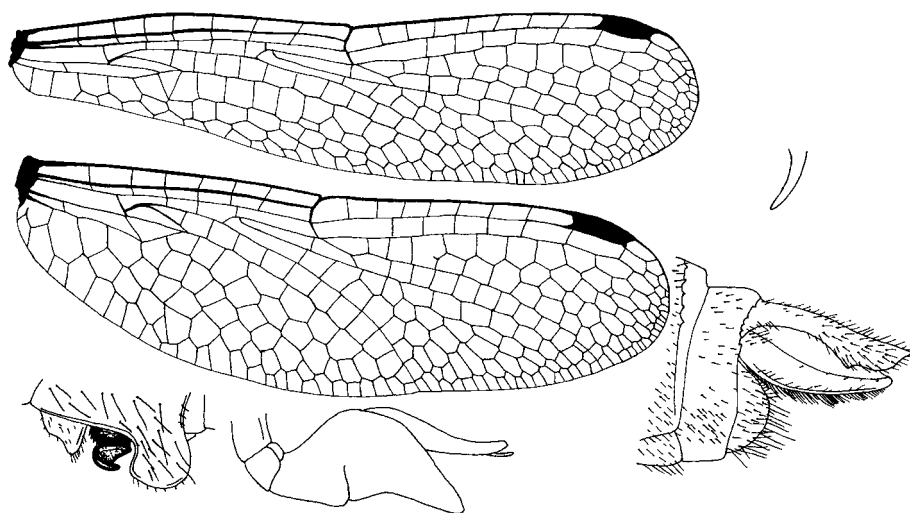


Fig. 3.2.315 *Oligoclada monosticha* male: fore and hind wing (upper left), genitalia on the second abdominal segment in lateral view (lower left), penis in lateral view (lower center), apex of the abdomen in lateral view (lower right), and tarsal claw (upper right). Based on Borror (1931).

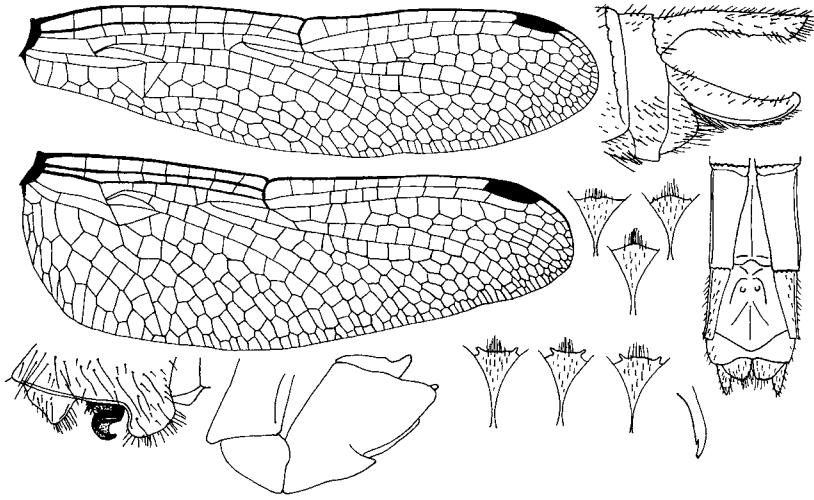


Fig. 3.2.316 *Oligoclada pachystigma*: fore and hind wing of a male (upper left), tarsal claw (lower right), occipital part of the head of three male specimens (right of hind wing) and of three female specimens (lower right center), male genitalia on the second abdominal segment in lateral view (lower left), penis in lateral view (lower left center), apex of the male abdomen in lateral view (upper right), and apex of the female abdomen in ventral view (middle right). Based on Borror (1931).

6. The tarsal claws have a distinct tooth inserted near the middle. There are two pale stripes on the sixth and seventh abdominal segments of the male. On the hind wing, there is a yellow trace at the basal subcostal cell, a yellow spot in the cubital cell as far as the first cross vein, and in the anal area as far as the two cells along the wing margin. In lateral profile, a row of teeth is evident on the ventral surface of the superior anal appendage of the male. In lateral view, the anterior lamina on the male genitalia is about as high as its length at the base (**Fig. 3.2.317**). There are 26 short spines in the external anterior row on the hind femur, and these are followed by a long spine near the distal end. The anterior keel on the frons of the male is somewhat distinct. Length of male abdomen: c. 21 mm. Hind wing length of male: c. 23 mm. Length of pterostigma on the forewing of the male: c. 2.74 mm.

.....*Oligoclada nemesis* (Ris, 1911)
(Minas Gerais, São Paulo). Syn: *Podothemis nemesis* Ris, 1911. It is not without reason that the validity of this species has been placed in doubt. The scarcity of specimens has hindered a study to determine whether, in fact, this and the next two nominal species are actually conspecific.

- The tarsal claws of some species have a small tooth inserted near the apex, and those of others have no tooth at all. The abdomen of the male lacks pale markings. The maximum length of the anterior lamina on the male genitalia is much greater than its height (**Fig. 3.2.314**).7

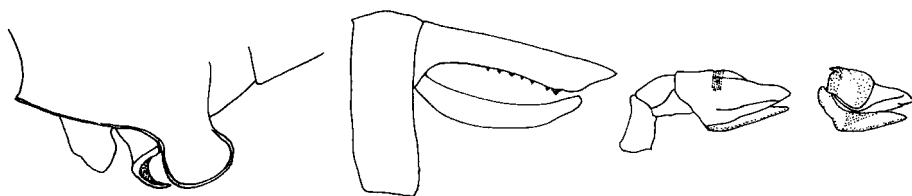


Fig. 3.2.317 *Oligoclada nemesis* (left to right): male genitalia on the second abdominal segment, lateral view of the anal appendages of a male, penis in lateral view, and penis without the right lateral lobe in lateral view. Based on Santos (1945d).

7. In lateral profile, no teeth are visible on the ventral margin of the superior anal appendage of the male. The anteroventral margin of the anterior lamina of the male genitalia is straight or convex (**Fig. 3.2.314**). The wings are entirely hyaline. The anterior keel on the frons of the male is somewhat distinct. Length of male abdomen: 15.9 to 17.0 mm. Hind wing length: 18.8 to 19.6 mm. Length of pterostigma: 1.7 to 2.4 mm. The thorax of the male is dark bluish black with a reddish brown metallic tinge. The abdomen of the male is metallic black with traces of reddish brown on the first through third segments and a reddish tinge from the posterior margin of the seventh segment to the anterior part of the ninth segment.

.....*Oligoclada stenoptera* Borror, 1931
(Ecuador, Peru, Mato Grosso).

- In lateral profile, teeth are visible on the ventral side of the superior anal appendage of the male. The anteroventral margin of the anterior lamina of the male genitalia is concave (**Fig. 3.2.318**). There is sometimes a yellow marking at the base of the hind wing, evident in immature specimens.

.....*Oligoclada rhea* Ris, 1911
(French Guiana, Pará).

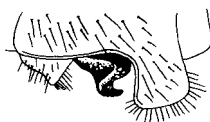


Fig. 3.2.318 *Oligoclada rhea*: genitalia on the second abdominal segment of a male in lateral view. Based on Borror (1931).

8. There is only a notch in the tarsal claw about 2/3 to 3/4 of the way from the base (**Fig. 3.2.316**).9
 - There is a distinct tooth on the tarsal claw located between a point 3/5 to 3/4 of the way from the base to the apex (**Fig. 3.2.319**).10

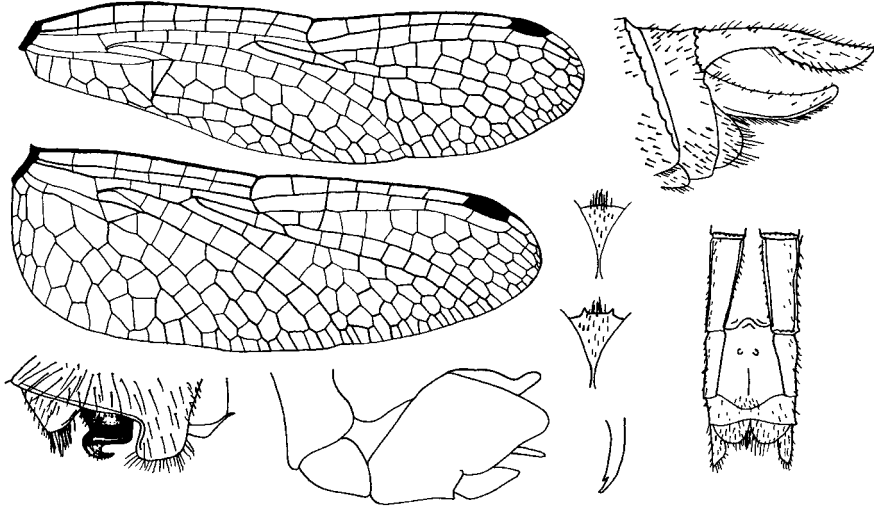


Fig. 3.2.319 *Oligoclada xanthopleura*: fore and hind wing of a male (upper left), tarsal claw (lower right center), occipital part of the head of a male and female (right of hind wing, above and below, respectively), male genitalia on the second abdominal segment in lateral view (lower left), penis in lateral view (lower left center), apex of the male abdomen in lateral view (upper right), and apex of the female abdomen in ventral view (lower right). Based on Borror (1931).

8. The genital lobe on the second abdominal segment of the male is broadly rounded at the apex and extends ventrad about the same distance as the hamule (**Fig. 3.2.316**). Length of abdomen: 14.3 to 17.5 mm. Hind wing length: 17.4 to 21.0 mm. Length of pterostigma: 1.5 to 2.3 mm.

.....*Oligoclada pachystigma* Karsch, 1890 (Ecuador, Peru, Venezuela, Guyana, French Guiana, Surinam, Paraguay, Mato Grosso, Mato Grosso do Sul, São Paulo).

- The genital lobe on the second abdominal segment of the male is obliquely truncate at the apex and extends ventrad not nearly as far as the hamule (**Fig. 3.2.320**). Length of male abdomen: c. 20 mm; female abdomen: c. 17 mm. Hind wing length: 21 to 23 mm. Length of pterostigma on fore-wing: 2.2 to 2.4 mm; on hind wing: 2.6 to 2.9 mm. The face and mouthparts of the male are almost entirely yellow with a black midline stripe. The frons and vertex of the male are shiny metallic blue, and the occiput is black. The head of the female is brown with yellow on the face, vertex, and occiput. The thorax is dark with a bluish

pruinescence. The abdomen of the male is almost black with bluish pruinescence on the dorsum of the second through fourth segments. That of the female has black patches on a mainly brown background. The wings are mainly hyaline with variable yellowish clouding.

.....*Oligoclada laetitia* Ris, 1911
(Argentina, Rio Grande do Sul, Rio de Janeiro, São Paulo, Minas Gerais).



Fig. 3.2.320 *Oligoclada laetitia*: genitalia on the second segment of the male in lateral view. Based on Borror (1931).

10. The pterostigma is at least 2.3 mm long. The abdomen of the male has no pale markings. The male has about $8\frac{1}{2}$ antenodal cross veins in the fore-wing and 6 or 7 in the hind wing. The hind wing lacks all markings. There are 17 short spines in the external row on the hind femur (**Fig. 3.2.321**). The anterior keel on the frons of the male is indistinct. Length of male abdomen: c. 17 mm. Hind wing length of male: c. 21 mm. Length of pterostigma on the fore-wing of the male: c. 2.35 to 2.5 mm. The ventral part of the frons is greenish yellow, and the dorsal part is bluish.

.....*Oligoclada borrori* Santos, 1945
(São Paulo).

- The pterostigma is no more than about 2.1 mm long.11

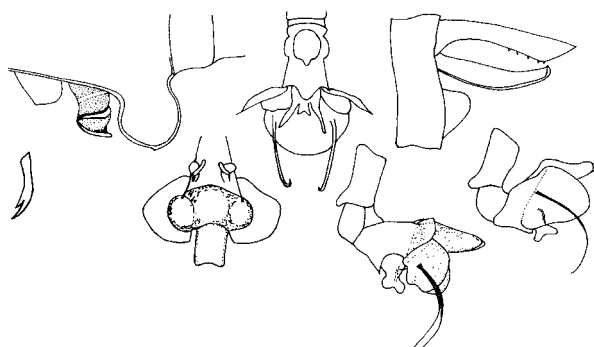


Fig. 3.2.321 *Oligoclada borrori* male (above, left to right): the genitalia on the second abdominal segment in lateral view, erect penis in ventral view, apex of the abdomen in lateral view, and (below, left to right): claw, erected penis in apical and lateral view, and non-erect penis in lateral view. Based on Santos (1945e).

11. The entire frons and vertex of the male are bluish black; the frons of the female is metallic blue, with a broad brown margin on the clypeal suture. The basal part of the labrum, anteclypeus, and postclypeus are white in the male, but the anteclypeus and postclypeus are dark brown with creamy whitish markings in the female. The apical 2/3 of the labrum is black. The occiput is black with a pair of reddish spots. In life, the compound eyes are bluish green. The thorax, of the male, including the legs, are black with a bluish pruinosity in places. The thorax of the female is dark brown with creamy whitish stripes and black legs. The distinct tooth on the tarsal claw is inserted at 3/5 of its length. There are 7 to 9½ antenodal cross veins in the fore-wing. The pterostigma is brown, and the membranule, black. The abdomen of the male is black with some bluish pruinosity in places and brown patches on the fourth through seventh segments; that of the female is reddish brown dorsally on the proximal and middle segments, and the rest is black with yellow bands on the second through fourth segments and pruinosity of the ventral surface. The vulvar lamina on the ninth abdominal segment of the female has a median excision in the approximate shape of a square (**Fig. 3.2.322**) or a semicircle. Total length without appendages: 20 to 21 mm. Length of abdomen: 12 to 13 mm. Hind wing length: 17 to 19.5 mm. Length of pterostigma in fore-wing: 1.2 to 1.4 mm.

.....*Oligoclada hypophane* DeMarmels, 1989
(Venezuela).

- The lower margin or more of the male frons is yellow or white. The distinct tooth on the tarsal claw is usually inserted at 3/4 of its length (**Fig. 3.2.319**). The fourth through eighth abdominal segments of the male are either uniform black, or there is some bluish pruinosity and yellowish brown lateral or ventral markings on them, including the eighth.12

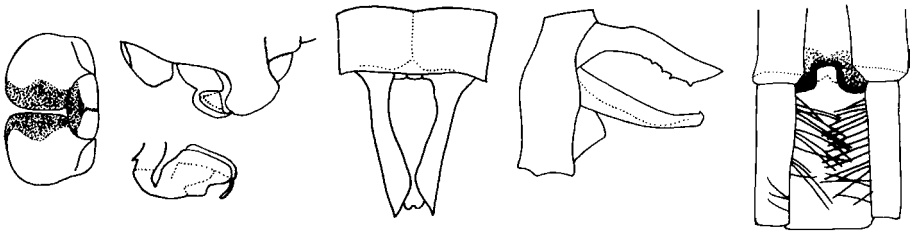


Fig. 3.2.322 *Oligoclada hypophane* (left to right): labium in ventral view, male genitalia on the second abdominal segment in lateral view (above), apex of penis in lateral view (below), apex of the male abdomen in dorsal and lateral view, and the vulvar lamina in ventral view. Based on DeMarmels (1989a).

12. There are six or seven antenodal cross veins in the fore-wing, and the one closest to the nodus is complete. The lower half of the frons is yellow. The fourth through eighth abdominal segments of the male are black with yellowish

brown lateral markings. The color of the ventral surfaces of all segments is similar. In the hind wing, there are always two rows of cells beyond the loop in the hind wing (**Fig. 3.2.319**). Length of abdomen: 14.0 to 15.1 mm. Hind wing length: 17.0 to 18.7 mm. Length of pterostigma: 1.3 to 1.8 mm.

.....*Oligoclada xanthopleura* Borror, 1931
(Amazonas).

- There are eight or more antenodal cross veins in the fore-wing, the one nearest the nodus is usually incomplete. The lower half of the frons is metallic blue with only the ventral margin yellowish. The fourth through eighth abdominal segments of the male are uniform blue or black. The color of the ventral surfaces of the seventh through ninth abdominal segments is red or reddish yellow, while the other segments differ in color (**Fig. 3.2.323**).13

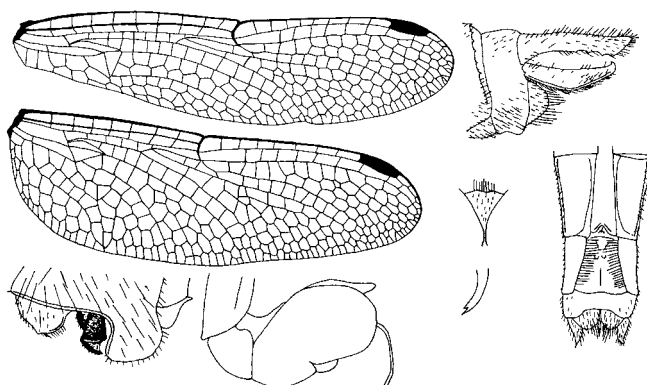


Fig. 3.2.323 *Oligoclada crocogaster* male: fore and hind wing (upper left), occipital part of head of a male in dorsal view (right of hind wing), tarsal claw (lower right center), genitalia on the second abdominal segment in lateral view (lower left), penis in lateral view (lower left center), apex of the male abdomen in lateral view (upper right) and of a female abdomen in ventral view (lower right). Based on Borror (1931).

13. The labrum of the male is entirely bluish black, and there is a black marking on its labium that completely covers the anterior margin. The rest of the labium, the anteclypeus, and postclypeus are white. The penis lacks an apical flagellum (**Fig. 3.2.324**). There is little red color on the ventral surfaces of the apical abdominal segments of the male. Length of male abdomen without appendages: 13 to 14 mm. Hind wing length: 19 to 21 mm. Length of pterostigma along costa: c. 1.7 mm. The female has not been described.

.....*Oligoclada leucotaenia* DeMarmels, 1989
(Venezuela). That this species is distinct from the following three is questionable.

- The entire labrum is not bluish black, or the labium does not have a black marking that covers its entire anterior margin. The penis has a short apical flagellum (**Fig. 3.2.323**).14

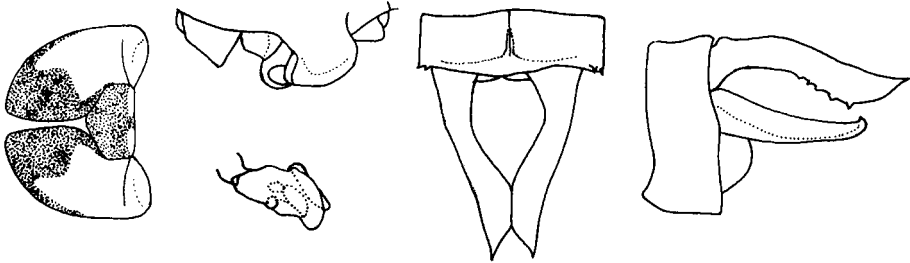


Fig. 3.2.324 *Oligoclada leucotaenia* (left to right): labium in ventral view, male genitalia on the second abdominal segment in lateral view (above), apex of penis in lateral view (below), and apex of the male abdomen in dorsal and lateral view. Based on DeMarmels (1989a).

14. The superior anal appendage is not distinctly longer than the inferior, and its basal half is often swollen, appearing in lateral view either as thin or thicker than the apical half with the thinnest point located about 2/3 of the distance from the base to the apex. The distal third is also somewhat swollen. The ventral surface of each superior anal appendage usually bears four to six small teeth located from about 2/3 of the length from the base to the inferior angle, which is rounded (**Fig. 3.2.325**). Length of abdomen: 13.5 to 15.1 mm. Hind wing length: 17.3 to 19.3 mm. Length of pterostigma: 1.5 to 2.0 mm.

.....*Oligoclada amphinome* Ris, 1919
(Venezuela, Guyana, French Guiana, Surinam, Amazonas, São Paulo).

- The superior anal appendage is distinctly longer than the inferior. There are four to six teeth on ventral surface of the superior anal appendage of the male, which are located in the apical half, at or proximal to the curve dorsad (**Fig. 3.2.323**).15

15. The genital lobe on the second abdominal segment of the male is large and extends farther ventrad than the apex of the hamule. The cornua of the penis is large and prominent. The basal half of the superior anal appendage is not swollen, appearing in lateral view either as thin or thinner than the apical half, often with the thinnest point located near the base. The ventral surface of each superior anal appendage usually bears four to six rather large teeth located between the middle and the inferior angle, which is not notably rounded (**Fig. 3.2.323**). Length of abdomen: 13 to 16 mm. Hind wing length: 17.5 to 22.0 mm. Length of pterostigma: 1.3 to 2.1 mm.

.....*Oligoclada crocogaster* Borror, 1931
(Pará, Rondônia).

- The genital lobe on the second abdominal segment of the male extends ventrad about the same distance as the apex of the hamule. The cornua of the penis is small and relatively inconspicuous. The superior anal appendage is swollen at the base and becomes thinner in the basal third than in the middle third. The ventral surface of each superior anal appendage usually bears a row of four small teeth located from well beyond the middle to the base of the evenly rounded subapical curve dorsad (**Fig. 3.2.326**). Total length, including anal appendages: 23 to 24 mm. Length of abdomen, including appendages: c. 15 mm. Hind wing length: c. 20.5 mm. Length of pterostigma: c. 1.5 mm. The female has not been described.

.....*Oligoclada waikinimae* DeMarmels, 1992
(Venezuela).

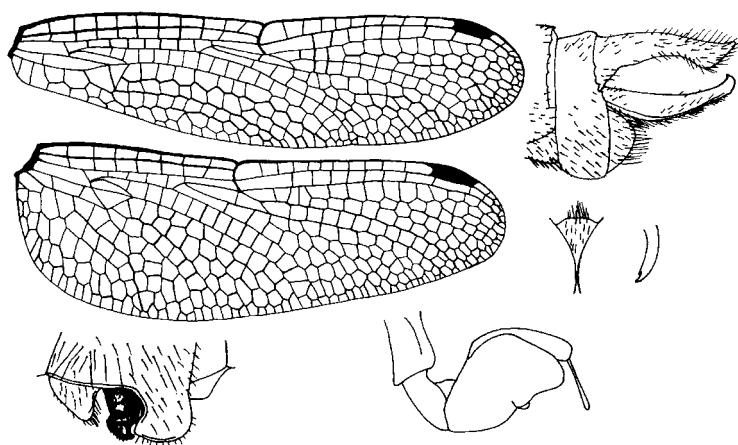


Fig. 3.2.325 *Oligoclada amphinome* male: fore and hind wing (upper left), occipital part of head in dorsal view (right of hind wing), tarsal claw (middle right), genitalia on the second abdominal segment in lateral view (lower left), penis in lateral view (lower right), and apex of the abdomen in lateral view (upper right). Based on Borror (1931).

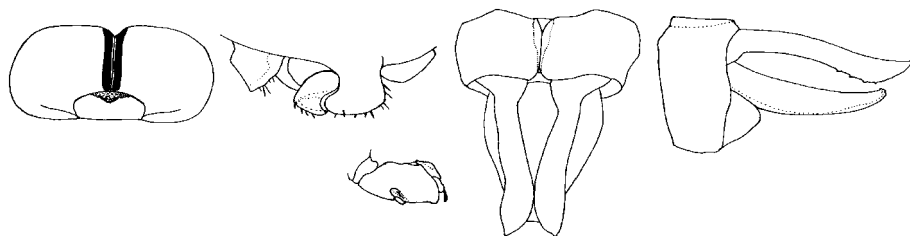


Fig. 3.2.326 *Oligoclada waikinimae* male (left to right): labium in ventral view, genitalia on the second abdominal segment in lateral view (above) and apex of the penis (below), and apex of the abdomen in dorsal and lateral view. Based on DeMarmels (1992).

16. There is a short, finger-like projection on each side of the posterior margin of the occiput. There is a tooth directed caudad on the anterior surface of the hamule. The ventral surface of the superior anal appendage bears six or more large teeth (**Fig. 3.2.314**). The penis has distinct, small medial, internal, lateral, and posterior lobes. The median lobes are simple and elongate, bearing many small teeth on the ventral edge. The posterior lobe is narrowed basally.17
 - The posterior margin of the occiput may be swollen but bears no finger-like projections. There is only a tooth directed anteriorad on the posterior surface of the hamule. The ventral surface of the superior anal appendage bears six or fewer small teeth (**Fig. 3.2.327**). The penis has median lobes that form an arch-shaped process. The other lobes are small. There are usually no teeth on the ventral edge of the median lobes. Sometimes the internal lobes appear to be missing. The posterior lobe is not narrowed basally.18

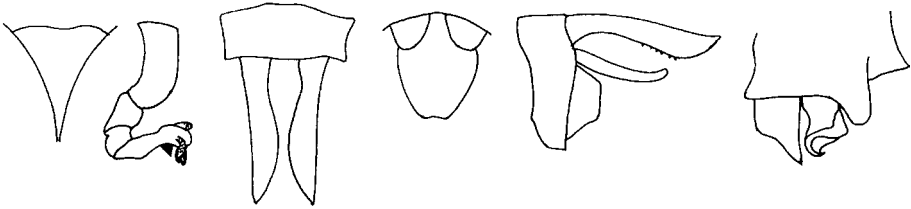


Fig. 3.2.327 *Oligoclada calverti* male (left to right): posterior margin of the occiput, penis in lateral view, superior anal appendage in dorsal view, inferior anal appendage in ventral view, apex of the abdomen in lateral view, and genitalia on the second abdominal segment in lateral view. Based on Santos (1951).

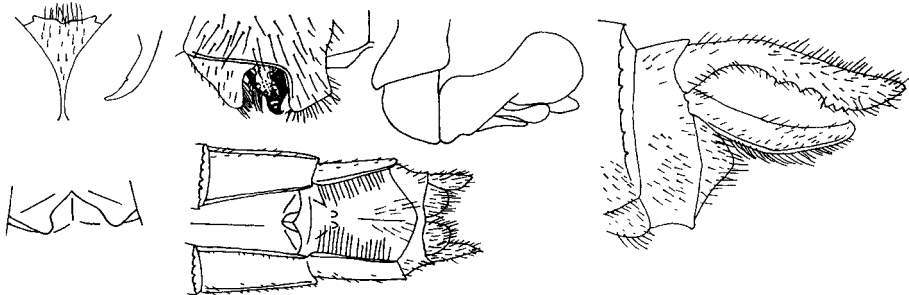


Fig. 3.2.328 *Oligoclada heliophila* (upper row, left to right): occipital part of the head of a male in dorsal view, tarsal claw, male genitalia on the second abdominal segment in lateral view, penis in lateral view (lower right), apex of the male abdomen in lateral view, and (below, left and right): vulvar lamina in ventral view and the apex of a female abdomen in ventral view. Based on Borror (1931).

17. The hamule is much narrower distally, at the base of the tooth, than at the base. There is a short, triangular thickening on either side of the V-shaped median incision on the vulvar lamina (**Fig. 3.2.328**). Length of abdomen: 15.1 to 19.1 mm. Hind wing length: 20.7 to 24.5 mm. Length of pterostigma: 1.9 to 2.4 mm.

.....*Oligoclada heliophila* Borror, 1931
(Central America, Colombia, Venezuela).

- The hamule is equally thick at the base and at the base of its tooth (**Fig. 3.2.329**). The female has not been described.

.....*Oligoclada abbreviata limnophila* Machado, 1993
(Species range: Ecuador, Peru, Venezuela, Guyana, French Guiana, Surinam, Amazonas, Rondônia, Pará, Roraima, Minas Gerais, São Paulo, Rio de Janeiro, Espírito Santo, Bahia, Pernambuco). Machado (1993) recognizes two subspecies, *O. abbreviata abbreviata* (Rambur, 1842), from the Amazon forest as far eastward as Pará, and *O. abbreviata limnophila* Machado, 1993 (Syn: *O. raineyi* Ris, 1913), in the states formerly covered by the Atlantic forest from Bahia and Pernambuco south to Rio de Janeiro. The metallic blue on the frons of male *O. a. abbreviata* spreads anteriorly and laterally as far as the ventral part and almost reaches the fronto-clypeal suture. The ventral part of the frons of male *O. a. limnophila* is mainly yellow. The abdomen of female *O. a. abbreviata* is about 14.7 mm, while that of female *O. a. limnophila* is 15.5 to 16 mm.

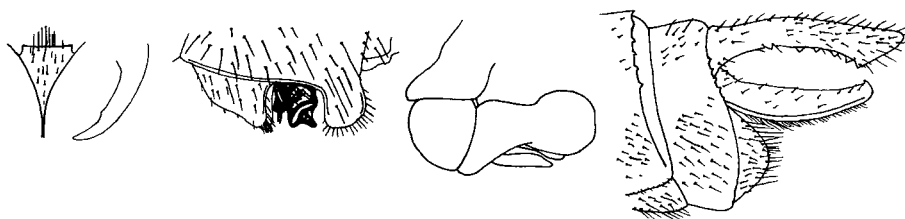


Fig. 3.2.329 *Oligoclada abbreviata limnophila* male (left to right): occipital part of the head in dorsal view, tarsal claw, genitalia on the second abdominal segment in lateral view, penis in lateral view, and apex of the abdomen in lateral view. Based on Borror (1931).

18. The posterior margin of the occiput appears to bear two lobes in dorsal view or bears a short projection directed caudad. In lateral view, the genital lobe and hamule extends about an equal distance ventrad, while the anterior lamina extends only slightly farther. The apex of the hamule appears rectangular and bears a tooth on the outer posterior angle, a knob-like process on the outer anterior angle, and a smaller, acute process on the middle posterior angle. The middle anterior angle is rounded. There is no spine, but there may be a knob

directed ventrad from a depressed portion at the distal end of the hamule (**Fig. 3.2.4, 3.2.89**). The female bears a white marking on the basal half of the inner surface of the fore-femur.

.....*Oligoclada abbreviata abbreviata* (Rambur, 1842)
(Species range: Ecuador, Peru, Venezuela, Guyana, French Guiana, Surinam, Amazonas, Rondônia, Pará, Roraima, Minas Gerais, São Paulo, Rio de Janeiro, Espírito Santo, Bahia, Pernambuco). See the comment in couplet 17.

- In dorsal view, the posterior margin of the occiput appears straight, slightly lobed without projections, or swollen with a wide, truncate process extending posteriad. The anterior lamina and hamule extend ventrad considerably farther than the genital lobe (**Fig. 3.2.327**).19

19. The anterior end of the hamule forms a small hook-like process directed posteriad. Each superior anal appendage of the male bears a row of about six small ventral teeth on its apical half (**Fig. 3.2.327**). The occiput does not appear to be swollen in dorsal view. The anterior and posterior margins of the anterior lamina are nearly parallel, and the posterior part is drawn out into a triangular process that ends in an acute angle. The abdomen is dark brown with bluish iridescence and a light middorsal stripe at least on the sixth and seventh segments.20

- The hamule appears to have an emargination forming a shallow curve and a smooth, rounded anterior edge at the apex; a short, thick spine extends from the depression formed. The anterior and posterior margins of the anterior lamina are strongly curved and not at all parallel (**Fig. 3.2.330**). There are two to five teeth on the ventral surface of the superior anal appendage, arranged in a single longitudinal row extending from the inferior angle.21

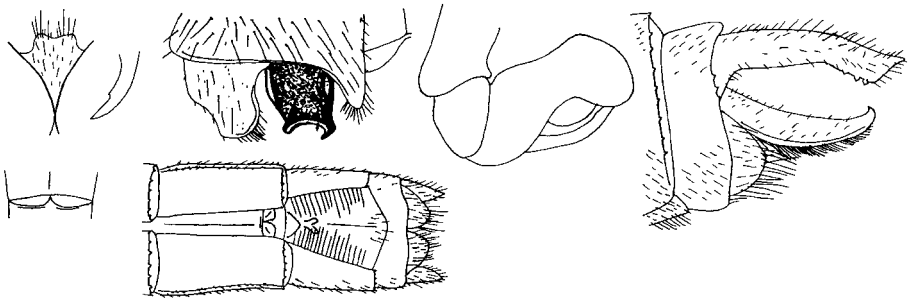


Fig. 3.2.330 *Oligoclada walkeri* (upper row, left to right): occipital part of the head of a male in dorsal view, tarsal claw, male genitalia on the second abdominal segment in lateral view, penis in lateral view, apex of the male abdomen in lateral view, and (below, left and right): vulvar lamina in ventral view and the apex of a female abdomen in ventral view. Based on Borror (1931).

20. The abdomen is dark brown with bluish iridescence, a dorsal stripe on the sixth segment, and stripes on the lateral carinas of the seventh. The labium of the male is black, and the labrum and clypeus are yellow. The frons and vertex of the male are metallic blue, and the occiput is black. The thorax and legs have a bluish pruinescence. The wings are hyaline with a gray membranula, black pterostigma, and small ochraceous area at the base of the hind wing. At the base, the anterior lamina of the male is parallel sided, and the apical portion is roughly triangular (**Fig. 3.2.327**). Length of female abdomen: 18 to 19 mm. Fore-wing length of male: 25 to 27 mm; hind wing: 24 to 26 mm.

.....*Oligoclada calverti* Santos, 1951
(Minas Gerais).

- The middorsal stripe on the female is not confined to the sixth and seventh segments but extends the full length of the abdomen. Length of female abdomen: c. 18 mm. Hind wing length of female: c. 23 mm.

.....*Oligoclada haywardi* Fraser, 1947
(Argentina).

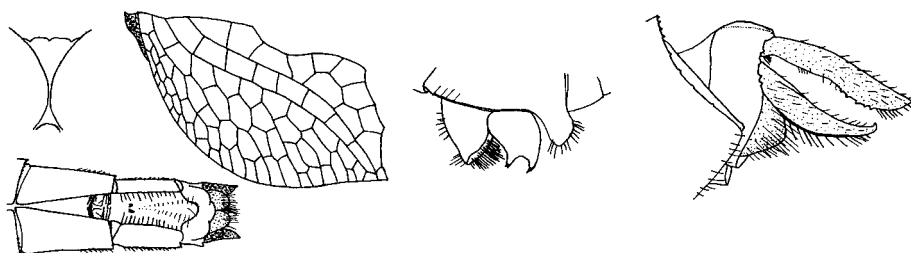


Fig. 3.2.331 *Oligoclada risi* (above, left to right): occipital part of head in dorsal view, anal loop and inner posterior corner of the hind wing, male genitalia on the second abdominal segment in lateral view, apex of a male abdomen in lateral view, and (below left): apex of a female abdomen in ventral view. Based on Geijskes (1984).

21. In dorsal view, the posterior margin of the occiput appears swollen with a wide, truncate, posteriad pointing process with a straight edge and a wide, shallow depression in the center. The distal section of the superior appendage in lateral view does not appear swollen, and it is as thick or thinner than the proximal section, has a distinct inferior angle, and is truncate at the apex (**Fig. 3.2.330**). Length of abdomen: 16.0 to 18.8 mm. Hind wing length: 21.0 to 22.8 mm. Length of pterostigma: 1.6 to 2.3 mm. The abdomen is reddish brown, darkening to black on the lateral surfaces of the sixth to tenth segment, so that

the ninth and tenth are almost entirely black. The female has no distinct white marking on the basal half of the fore-femur.

.....*Oligoclada walkeri* Geijskes, 1931
(Trinidad, Ecuador, Peru, Venezuela, Guyana, French Guiana, Surinam, Pará, Mato Grosso).

- The occiput lacks distinct processes and is either lobed or almost evenly convex (**Fig. 3.2.331**).22

22. In dorsal view, the occiput is seen to have two flattened lobes divided by a slight depression along the midline and bordered by deeper lateral depressions; there are no processes on the occiput. There is a row of about five teeth on the ventral surface of the superior anal appendage of the male (**Fig. 3.2.331**). Length of abdomen, including appendages: 14 to 16 mm. Hind wing length: 20.5 to 21 mm. Length of pterostigma: c. 2 mm. The abdomen of the male is black with the first three segments somewhat enlarged. The first six segments of the female abdomen are reddish brown with blackened margins. The seventh is mainly black with a brown spot along the dorsal midline. The eighth through tenth segments are black.

.....*Oligoclada risi* Geijskes, 1984
(Venezuela, French Guiana, Surinam, Pará).

- In dorsal view, the posterior margin of the occiput appears evenly convex with a straight posterior margin or a pair of barely distinct lateral lobes. The distal section of the superior appendage in lateral view appears swollen with a rounded inferior angle; there is a row or two to four teeth on the ventral surface (**Fig. 3.2.332**). Length of male abdomen: 16.5 to 18.0 mm. Hind wing length of male: 22 to 24 mm. Length of pterostigma: 1.9 to 2.4 mm. The female has not been described. The abdomen is reddish brown, darkening to black on the lateral surfaces of the sixth to tenth segment, so that the ninth and tenth are almost entirely black. The female has no distinct white marking on the basal half of the fore-femur.

.....*Oligoclada umbricola* Borror, 1931
(Central America, Colombia, Ecuador, Venezuela).

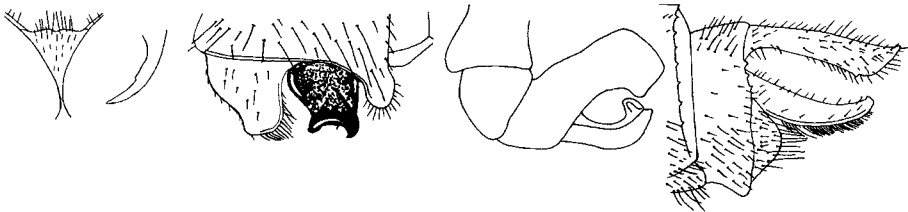


Fig. 3.2.332 *Oligoclada umbricola* male (left to right): occipital part of the head in dorsal view, tarsal claw, genitalia on the second abdominal segment in lateral view, penis in lateral view, and apex of the abdomen in lateral view. Based on Borror (1931).

Key to the species of adult *Dasythemis* in South America

Information for the key was provided by Ris (1910b) and Santos (1947b).

1. The anal loop in the hind wing consists of 13 or 14 cells and extends at least two cell widths farther toward the wing apex than the distal angle of the triangle. Vein Cu_1 in the fore-wing is relatively short and strongly curved, and the discoidal field widens considerably toward the wing margin. The triangle is sometimes crossed, and the subtriangle is usually crossed, dividing it into two or three cells (**Fig. 3.2.333**). The anterior lamina is low. The ventral extension of the tenth abdominal segment of the female does not extend beyond the apices of the superior anal appendages.

.....*Dasythemis mincki* (Karsch, 1890)
(Argentina, Paraguay, Uruguay, Rio Grande do Sul, Santa Catarins, São Paulo, Rio de Janeiro, Espirito Santo, Minas Gerais, Goiás). Syn: *Malamarptis mincki* Karsch, 1890. Two subspecies have been described: *Dasythemis mincki mincki* (Karsch, 1890) from southern Brazil and adjacent countries, characterized by a dark brown pterostigma and the velvety-black thorax and yellow midline of the male; *Dasythemis mincki clara* Ris, 1908 from Argentina, recognized by its light yellowish brown pterostigma and coppery olive thorax with a light yellow midline bordered by a somewhat darker color.

- The anal loop in the hind wing consists of no more than about 9 cells, and it extends at most, less than one cell width closer to the apex of the wing than the distal angle of the triangle. The discoidal field in the fore-wing widens very little toward the wing margin. The triangle and subtriangle of the fore-wing are almost always free of cross veins (**Fig. 3.2.334**).2

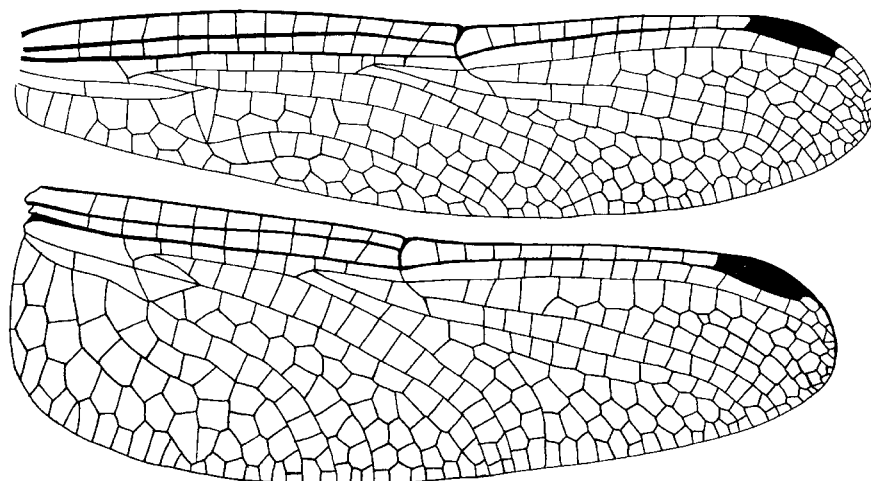


Fig. 3.2.333 Fore and hind wing of *Dasythemis mincki*. Based on Gloger (1962).

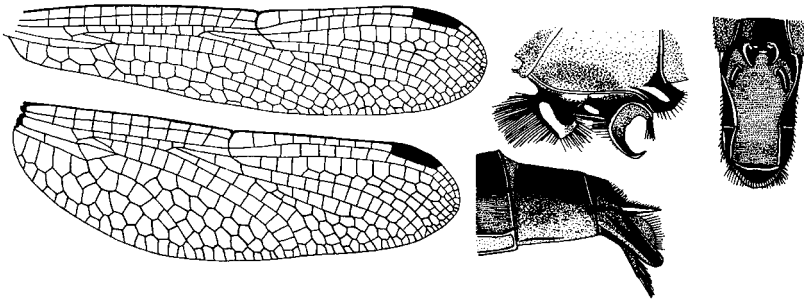


Fig. 3.2.334 *Dasythemis esmeralda*: fore and hind wing (left), male genitalia on the second abdominal segment (upper center), and apex of the female abdomen in ventral (right) and lateral view (lower center). Based on Ris (1910).

2. In the hind wing, there are 8 or 9 cells in the anal loop, and in the fore-wing of the female, there are two cells in the proximal part of the discoidal field, while the number in the male is variable (**Fig. 3.2.91**). The anterior lamina of the male is low, and the hamule is upright but small. The ventral margin of the tenth segment of the female is greatly elongated and extends beyond the apices of the superior anal appendages. Total length: 24 to 26 mm. Hind wing length of male: 27 to 28 mm; female: c. 30 mm. The abdomen of the mature male is pruinose and has a grayish blue color; that of the female is mainly dull reddish brown with yellow dorsal markings on the first three segments, black lateral stripes on the fourth through seventh segments, and completely black eighth through tenth segments. The thorax of a mature male is almost uniformly shiny coppery black with obscure markings, while those of newly emerged males and females are brown with many yellow markings, including a midline stripe. The wings are hyaline or sometimes show some yellowing. The pterostigma is dark brown, and the membranule is tiny and blackish. The legs are black, except for the yellow underside of the female fore-femur.

.....*Dasythemis venosa* (Burmeister, 1839)
(Argentina, Paraguay, São Paulo, Rio de Janeiro, Minas Gerais, Espírito Santo, Bahia, Mato Grosso). Syn: *Libellula venosa* Burmeister, 1839; *Dasythemis macrostigma* Förster, 1907; *Dythemis lirioppe* Hagen, 1861 (*nomen nudum*).

- In the hind wing, there are only 4 or 5 cells in the anal loop, and in the fore-wing, there is a single row of cells in the proximal part of the discoidal field, which runs apicad from the distal side of the triangle.3

3. The abdomen is mainly black with lateral red markings also present in the female. The thorax is almost uniform in color and lacks prominent lateral stripes. The wings of the male are hyaline, and those of the female have a yellow tint in the basal half. The pterostigma is black. The legs are black, except for the yellow underside of the female fore-femur. The anterior lamina of the male is large, and the hamule has a long, thin anterior lobe (**Fig. 3.2.334**). The ventral margin of the tenth segment of the female is greatly elongated. The ventral plate on the ninth abdominal segment of the female is narrow at its apex. Length of abdomen: 22 to 23 mm. Hind wing length of male: c. 26 mm; female: c. 24 mm. Length of pterostigma: 2 to 2.5 mm.

.....*Dasythemis esmeralda* Ris, 1910
(Trinidad, Colombia, Ecuador, Peru, Venezuela, Surinam, French Guiana, Bolivia, São Paulo, Mato Grosso).

- The abdomen of the male is reddish brown with black borders to the segments and black at the apex. The lateral surface of the thorax has strongly contrasting brown and yellow stripes. The wings of the male are hyaline. The pterostigma is black. The anal appendages of the male are slender, with the superior appendage slightly longer than the inferior (**Fig. 3.2.335**). Length of abdomen including appendages: 19 to 21 mm. Hind wing length of male: c. 22.5 mm; female: c. 26 mm. Length of pterostigma on fore-wing: 2.5 to 3.0 mm.

.....*Dasythemis essequiba* Ris, 1919
(Peru, Guyana, Surinam, French Guiana, Amazonas, São Paulo).

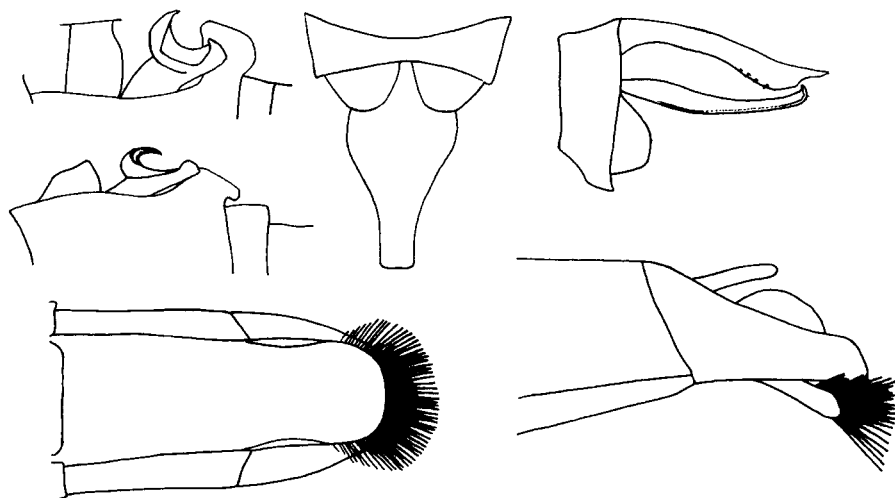


Fig. 3.2.335 *Dasythemis essequiba*: right side of the male genitalia on the second abdominal segment in ventral (upper left) and right lateral view (middle left), inferior anal appendage of the male in ventral view (upper center), apex of the male abdomen in lateral view (upper right), apex of the female abdomen in ventral (lower left) and lateral view (lower right). Based on Santos (1947b).

Key to the species of two known *Dasythemis* larvae in South America

Information for the key was provided by Ris (1910) and Carvalho *et al.* (2002).

1. There are well-developed lateral spines on the eighth and ninth abdominal segments, visible in dorsal view (**Fig. 3.2.111**).

.....*Dasythemis venosa* (Burmeister, 1839)
(Argentina, Paraguay, São Paulo, Rio de Janeiro, Minas Gerais, Espírito Santo, Bahia, Mato Grosso). Syn: *Libellula venosa* Burmeister, 1839; *Dasythemis macrostigma* Förster, 1907; *Dythemis liriopoe* Hagen, 1861 (*nomen nudum*).

- There are no lateral spines on the eighth and ninth abdominal segments (**Fig. 3.2.336**).

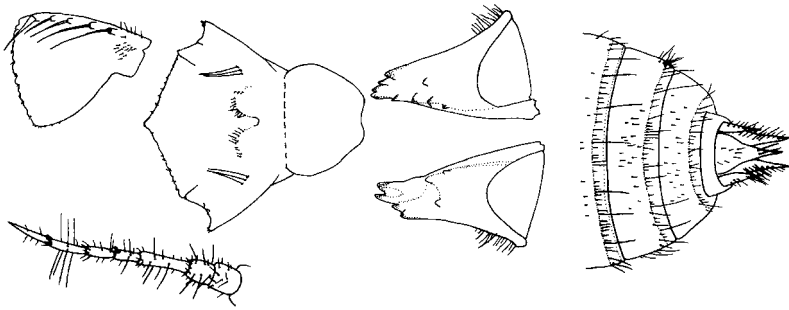


Fig. 3.2.336 *Dasythemis mincki* larva: labial palp in dorsal view (upper left), antenna (lower left), prementum in dorsal view (upper left center), inner surfaces of the mandibles (right center), and the apex of the abdomen in dorsal view (right). Based on Carvalho *et al.* (2002).

Key to the species of adult *Anatya* in South America

Information for the key was provided by Ris (1911a). From the anatomical differences reported, it is difficult to conclude that this group encompasses more than one valid species. *Anatya normalis* Calvert, 1999, is still carried as a valid species on many lists, even though Ris (1911a) found no consistent morphological differences between it and *A. guttata* other than a slightly smaller size and its occurrence farther south. The size range, however, overlaps that of *A. guttata*. DeMarmels (1992) also concluded that *A. normalis* is probably a synonym of *A. guttata*, and that conclusion seems correct. Information is still insufficient to produce a key to the larvae.

1. The superior anal appendage of the male is dark at the base and apex and dull olive on the middle third (**Fig. 3.2.337**). Length of abdomen: 23 to 24 mm. Hind wing length: 25 to 28 mm. Length of pterostigma: 2.5 to 3.0 mm. The female is

brownish yellow with a metallic sheen on the dorsal parts of the head, greenish with dark markings on the thorax, and abdomen is dull reddish brown with yellow markings.

.....*Anatya januaria* Ris, 1911
(São Paulo, Rio de Janeiro, Espirito Santo?).

- The male superior anal appendages are blackish at their bases, yellowish in the middle, and olive green on the apical third. The length of the apical portion may show considerable variation (**Fig. 3.2.338**). This coloration becomes less distinct in some darker specimens. The inferior anal appendage is blackish at the base, yellow for most of its length, and darkened at the apex. The head, thorax, and abdomen of the male, including the pterostigma and legs, are largely black with greenish yellow or yellow on a large lateral area of the thorax, the ventral surface of the abdomen, the coxae, trochanters, and basal halves of the femora and on small dorsolateral markings on the fourth through sixth abdominal segments. The first through third abdominal segments have greenish yellow or bluish grey markings. The compound eyes are reddish brown or tinged with green. The coloration of the female is much lighter. The ground color is light reddish brown, and the yellow markings are more extensive. Only the apical parts of the legs and anterior part of each pterostigma are blackish. The posterior margin of each pterostigma and the superior anal appendages are yellow. The wings of both males and females are otherwise hyaline with black veins in the anterior parts and brown posterior veins. Length of pterostigma: 2.0 to 2.5 mm.

.....2

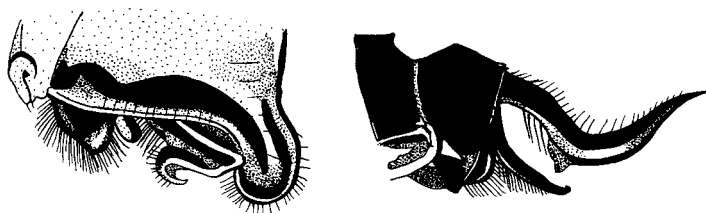


Fig. 3.2.337 *Anatya januaria* male: lateral views of the genitalia on the second abdominal segment (left) and apex of the abdomen (right). Based on Ris (1911a).

2. Ris (1911a) found no reliable way to distinguish the two species in this couplet other than size. However there is overlap in the size ranges. Differences in the wing are minor (**Fig. 3.2.338**). Length of abdomen: 23 to 27 mm. Hind wing length: 25 to 29 mm.

.....*Anatya guttata* (Erichson, 1848)
(Trinidad, Ecuador, Peru, Venezuela, Guyana, Surinam, French Guiana, Bolivia, Mato Grosso). Syn: *Libellula guttata* Erichson, 1848; *Anatya anomala* Kirby,

1889; *Agrionoptera difficilis* Selys, 1879; *Anatya theresiae* Selys, 1900; probably *Anatya normalis* Calvert, 1899.

- Length of abdomen: 19 to 23 mm. Hind wing length: 22 to 26 mm. Differences in the wing are minor (**Fig. 3.2.93**).

.....*Anatya normalis* Calvert, 1999 (Mexico, Central America, Colombia, Paraguay, Argentina). According to DeMarmels (1992), this species should not be considered as distinct from *Anatya guttata*.

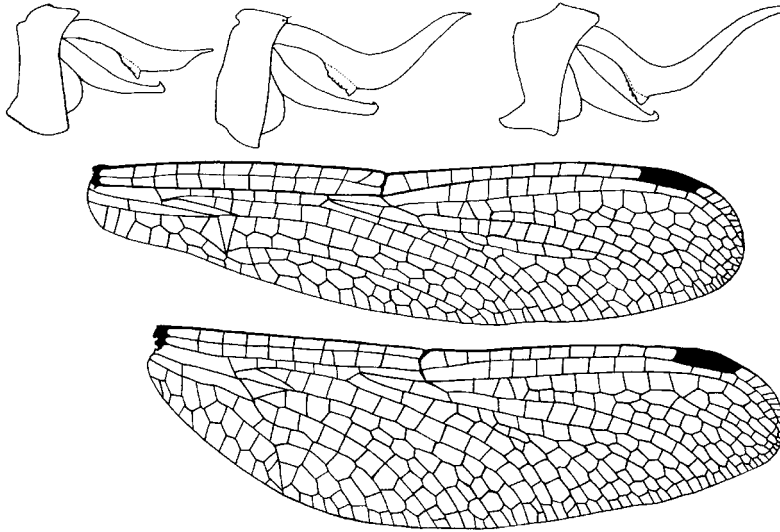


Fig. 3.2.338: *Anatya guttata*: fore and hind wing (below) and the apices of the abdomens of three males with superior appendages of different lengths (above). Based on DeMarmels (1992), who believes that the differences in the appendages result from intraspecific variability.

Key to the species of adult *Sympetrum* in South America

Information for the key was provided by Böttger and Jurzitza (1967) and DeMarmels (1992, 1998, 2001).

1. The abdomen of the male is nearly uniform bright red or reddish brown, and that of the female is uniform brown (**Fig. 3.2.339**). If some darkened areas are present, they are limited to dorsal markings on a few segments and vague darkening laterally or ventrally. In no case, is there a distinct checkered pattern of light and dark.2
- The abdomen is not uniform in color but rather has a pattern of spots, giving it a checkered appearance (**Fig. 3.2.96**).5

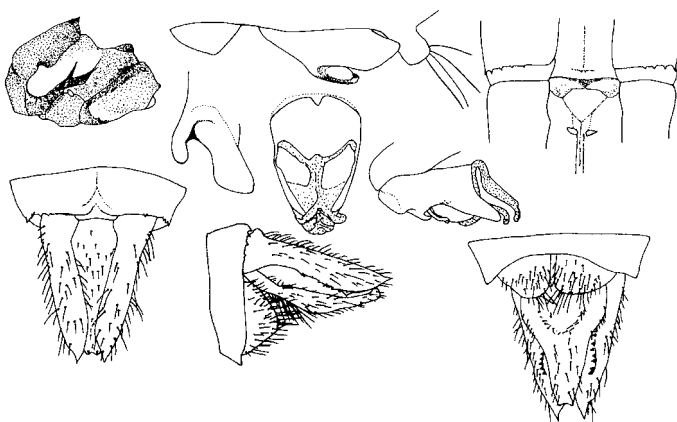


Fig. 3.2.339: *Sympetrum evanescens*: lateral view of the synthorax of a female (upper left), male genitalia on the second abdominal segment in lateral view (upper center), right hamule in ventral view and the penis in ventral and lateral view (beneath male genitalia, left to right), apex of the male abdomen in dorsal, lateral, and ventral view (lower row, left to right), vulvar lamina of a female in ventral view (upper right). Based on DeMarmels (1992).

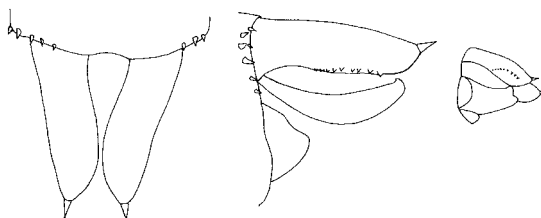


Fig. 3.2.340 *Sympetrum villosum* male (left to right): the apex of the abdomen in dorsal, lateral, and ventrolateral view to a smaller scale. Based on Schmidt (1974).

2. There is a blackish dorsal markings on the eighth abdominal segment of both sexes and on the sixth and seventh segment of the male, as well. The area posterior to the nodus on each wing is reddish or orange, and this color may be present along the entire costal and subcostal spaces and elsewhere on the anterior part of the wing. The tibiae are dark in color. In lateral view, the inferior anal appendage of the male reaches beyond the ventral spine on the superior anal appendage (**Fig. 3.2.340**).

.....*Sympetrum villosum* Ris, 1911
(Chile).

- Any darkening on the dorsal surface of the abdomen is limited to small vague area on the eighth segment of the male.3

3. The tibiae and tarsi are brownish black. There is a dark stripe on the head anterior to the vertex. The dorsal surface of the frons is red or brown with black markings anterior to the middle ocellus and bordering the compound eyes. The hind wing lacks a brown spot in the subcostal space, and amber coloration is limited the extreme base, well proximal to vein ax₁. The veins in the fore-wing of the female are black, and those of the male are red. There are usually 9.5 ax in the fore-wing. The color pattern on the abdomen is simple; that of the male is mainly a uniform dark red with a black marking in the middle of the dorsal surface of the eighth and ninth segments. The inferior anal appendage of the male reaches the spine on the superior anal appendage (Fig. 3.2.339). Total length: 43.3 to 44.0 mm. Length of abdomen including appendages: 27 to 28 mm. Hind wing length: 32 to 34 mm.

.....*Sympetrum evanescens* DeMarmels, 1992 (Venezuela). This species was recommended for consideration as an endangered species in Venezuela (DeMarmels, 1999).

- The femora and tibiae are mainly light brown or reddish with variable blackish markings at the apices of the femora and sometimes elsewhere, and the tarsi are usually black.4

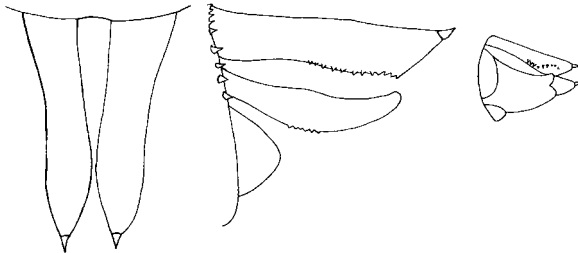


Fig. 3.2.341 *Sympetrum illotum* male (left to right): the apex of the abdomen in dorsal, lateral, and ventrolateral view to a smaller scale. Based on Schmidt (1974).

4. In lateral view, the ventral surface of the superior anal appendage of the male is arched along the basal $\frac{3}{4}$ of its length and then angled dorsoposteriad; there is a ventral tooth where it is angled, which is directly above the apex of the inferior anal appendage. The arched part of the ventral surface of the superior appendage is lined by widely-spaced teeth for more than half its length; in ventral view, this row of teeth is evenly curved (Fig. 3.2.341). The male is uniform bright red or red with a few dark markings. The wing veins of both males and females vary from bright red to light brown.

.....*Sympetrum illotum* (Hagen, 1861)

(North to Central America and reported from other parts of the world). Syn: *Mesothemis illotum* Hagen, 1861. This species seems to be absent from South America although it appears in numerous lists from the continent, which were compiled while the South American *S. gilvum* was considered to be a subspecies of *S. illotum*.

- There is no dark stripe on the head anterior to the vertex. On the hind wing, the dark brown spot in the subcostal space almost reaches or extends beyond vein ax_1 , and the amber shading at the base reaches at least as far as the apex of the triangle (**Fig. 3.2.342**). Length of male abdomen: c. 21.5 mm. Hind wing length of male: c. 24.6 mm.

.....*Sympetrum gilvum* (Selys, 1884)
(West Indies, Colombia, Ecuador, Peru, Venezuela, Argentina, Chile). Syn: *Diplax illotum gilvum* Selys, 1884.

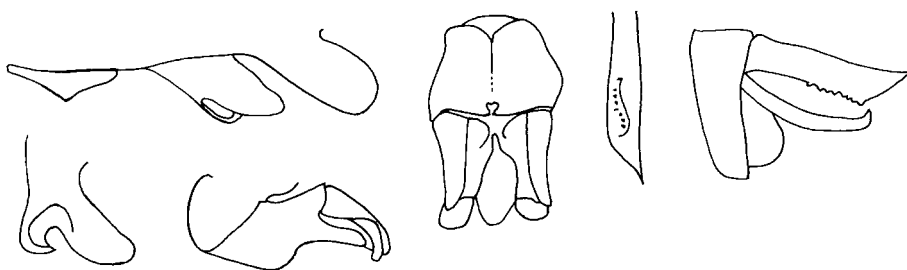


Fig. 3.2.342 *Sympetrum gilvum* male (left to right): lateral view of the genitalia on the second abdominal segment above the hamule in lateroventral view (left) and the apex of the penis in lateral view (right), penis in ventral view, superior anal appendage in ventral view, lateral view of the apex of the abdomen. Based on DeMarmels (2001).

5. The lateral surface of the synthorax is brownish black with a broad white stripe running from the anteroventral corner of the mesepimeron to the posterodorsal angle of the metepisternum. In the male genitalia, the outer branch of the hamule is sac-like, conical, and curved slightly outward at the apex. The posterior half of the dorsal surface of the frons is black, and its anterior half is white. The wing veins are black. There are usually only 7.5 ax in the fore-wing. The abdomen has a bright color pattern that is mainly ochraceous on the dorsal surface and black laterally. The inferior anal appendage of the male does not reach the spine on the superior anal appendage (**Fig. 3.2.96**). Total length: 38.9 to 41.0 mm. Length of abdomen including appendages: 24.9 to 27.0 mm. Hind wing length: 28.1 to 29.4 mm.

.....*Sympetrum paramo* DeMarmels, 2001
(Venezuela).

- The lateral surface of the synthorax does not have a broad white stripe running from the anteroventral corner of the mesepimeron to the posterodorsal angle of the metepisternum; any white coloration is limited in its extent. In the male genitalia, the outer branch of the hamule is not curved slightly outward at the apex (**Fig. 3.2.343**).6



Fig. 3.2.343 *Sympetrum roraimae* (upper row, left to right): color pattern on the pterothorax, lateral view of the male genitalia on the second abdominal segment, secondary genitalia in ventral view, and the penis in lateral view, and (lower row, left to right): the apex of the male abdomen in dorsal and lateral view, and the eighth abdominal sternite of a female showing the vulvar lamina. Based on DeMarmels (1988).

6. The brown basal spot in the subcostal space of the hind wing has an especially dark area that reaches vein ax_1 , and the hind wing has two to five double cells at the margin of the wing between MA and RP_{3+4} . There are three or more such cells between Cu_1 and the vein that arises from the heel. In lateral view, the superior anal appendage of the male curves ventrad (**Fig. 3.2.343**).

.....*Sympetrum roraimae* DeMarmels, 1988.
(Venezuela, Roraima).

- The brown basal spot in the subcostal space of the hind wing has an especially dark area that nearly reaches vein ax_2 , and the hind wing has no more than one or two double cells at the margin of the wing between MA and RP_{3+4} . There are two or three such cells between Cu_1 and the vein that arises from the heel. In lateral view, the superior anal appendage of the male is nearly straight (**Fig. 3.2.344**).

.....*Sympetrum chaconi* DeMarmels, 1994
(Venezuela).

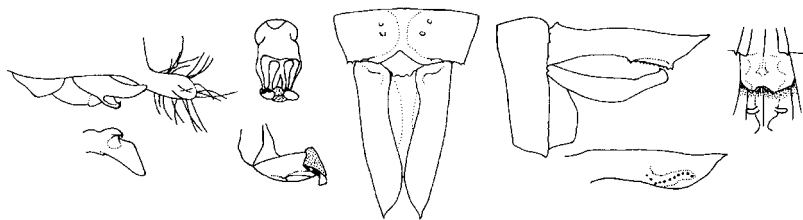


Fig. 3.2.344 *Sympetrum chaconi* (left to right): male genitalia on the second abdominal segment in lateral view above a ventral view of the apex of a hamule, the penis in ventral (above) and lateral view (below), apex of the male abdomen in dorsal and lateral view above a ventral view of a superior anal appendage, and a ventral view of the vulvar lamina on the ninth abdominal segment of a female. Based on DeMarmels (1994).

Key to the species of known *Sympetrum* larvae in South America

Information for the key was provided by DeMarmels (1992) and Muzón and von Ellenrieder (1997a).

1. There are nine long setae in the row proximal to the movable hook and about 14 setae in a curved row on each side of the prementum. The abdomen has a distinct pattern of light and dark, including a light middorsal area on the sixth through ninth segments bordered by darker dosolateral markings, most extensive on the eighth and ninth segments. The lateral spines on the eighth abdominal segment are very small (**Fig. 3.2.136**).

.....*Sympetrum evanescens* DeMarmels, 1992 (Venezuela). This species was recommended for consideration as an endangered species in Venezuela (DeMarmels, 1999).

- There are fewer than nine long setae in the row proximal to the movable hook. The pattern on the abdomen is less distinct, with rows of small dark spots on a more uniform lighter color and only a slight dorsolateral darkening on the sixth through ninth segments (**Fig. 3.2.345**).2

2. On the fourth through the eighth abdominal segments, there is a small dark, crescent-shaped marking in a pale area near the lateral margin. There are 14 or 15 setae in a curved row on each side of the prementum (**Fig. 3.2.345**).

.....*Sympetrum villosum* Ris, 1911 (Chile).

- There are no dark crescent-shaped markings near the lateral margins of the fourth through eighth abdominal segments (**Fig. 3.2.346**).

.....*Sympetrum gilvum* (Selys, 1884) (West Indies, Colombia, Ecuador, Peru, Venezuela, Argentina, Chile). Syn: *Diplax illotum gilvum* Selys, 1884.

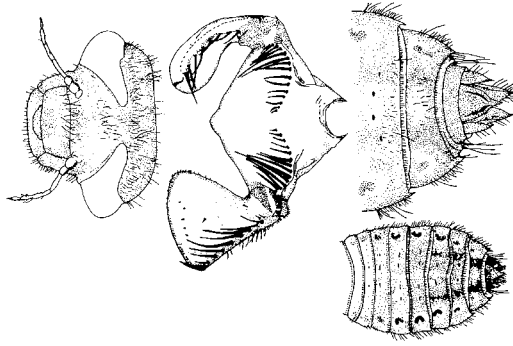


Fig. 3.2.245: *Sympetrum villosum* male larva: head in dorsal view (left), labium (center), half of the labium of a male showing one lobe in dorsal view (upper right), abdomen in dorsal view below its enlarged apex (right). Based on Muzón and von Ellenrieder (1997a).

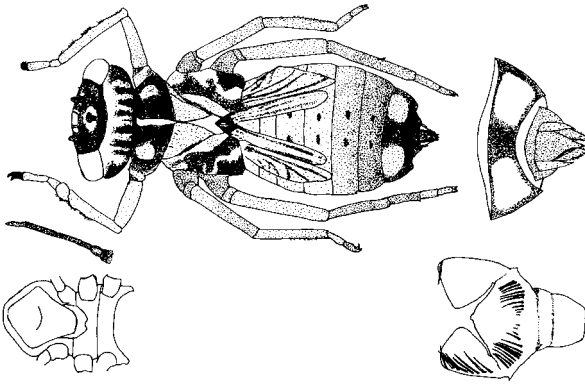


Fig. 3.2.346 *Sympetrum gilvum* larva: habitus (upper left), antenna (middle left), ventral view of the head and thorax (lower left), labium (lower right), and apex of the abdomen in dorsal view. Based on Limongi (1990).

Key to the species of adult *Planiplax* in South America

Information for the key was provided by Santos (1949a) and Geijskes (1964a).

1. The triangle of the fore-wing is crossed to form two cells, and the subtriangle is divided into three cells (**Fig. 3.2.97**).2
- The triangle and subtriangle of the fore-wing are not crossed. The last antenodal cross vein is always complete. The genital lobe of the male is subquadratic or wider than long and rounded (**Fig. 3.2.347**).3

2. Males have brown clouds at the bases of the wings, while the wings of the females are completely hyaline. The abdomen of the male is reddish yellow, and that of the female is dark brown. The frons of the male has a small anterior shield and is metallic blue. There are $9\frac{1}{2}$ to 11 antenodal cross veins in the forewing, and 8 to 11 in the hind wing. The genital lobe is longer than wide and rounded (**Fig. 3.2.97**). Length of abdomen: 23 to 25 mm. Hind wing length: 29 to 31 mm.

.....*Planiplax erythropyga* (Karsch, 1891)
(Argentina, Uruguay, Rio Grande do Sul). Syn: *Platylax erythropyga* Karsch, 1891.

- Neither males nor females have brown clouds at the bases of their wings, which are hyaline with black veins and a dull yellow pterostigma bordered by and infused with black. The male abdomen is mainly deep red; the female abdomen is mainly dull yellowish brown with black transverse carina on the third and fourth segments, reddish brown on the eighth and ninth, and dark brown on the tenth segment. Ventrally, the abdomen is mainly yellowish without black markings. Total length of the female: c. 41 mm. Length of the female abdomen: 26 mm. Hind wing length of female: c. 31 mm. Length of pterostigma: 3 mm. The wings are hyaline with black veins, and they have yellow pterostigmata and no basal spots. The posterior ventral margin of the eighth abdominal segment of the female is divided into two divergent, thickened lobes (**Fig. 3.2.348**). The head of the female is dull brown with an ivory white face, metallic blue on the frons, yellow genae, and black antennae. The thorax of the female is dull brown with light yellowish green stripes.

.....*Planiplax arachne* Ris, 1912
(Peru, Venezuela, Surinam, Mato Grosso). Syn: *Libellula plebeja* Burmeister, 1839; *Leptemis verbenata* Hagen, 1861.

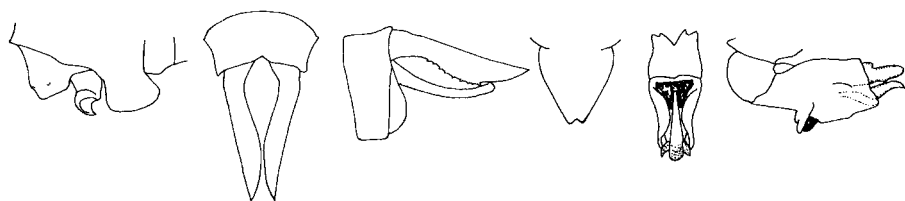


Fig. 3.2.347 *Planiplax machadoi* male (left to right): the genitalia on the second abdominal segment in lateral view, superior anal appendages in dorsal view, apex of the abdomen in lateral view, the ventral anal appendage in ventral view, and the penis in ventral and lateral view. Based on Santos (1949a).

3. The frons of the male is red, lacks a shield, but has a deep median groove. The genital lobe of the male is wider than long and rounded (**Fig. 3.2.347**). Length of abdomen: c. 24 mm. Hind wing length: c. 30 mm. The head and thorax are

ferrugineous with a reddish frons. The bases of the wings are clouded with yellow brown, more intense in the hind wing. The pterostigma is brown, and the membranule is gray. The dorsal surface of the male abdomen is bright carmine.

.....*Planiplax machadoi* Santos, 1949
(Peru, Amazonas).

- The frons of the male is metallic blue and has an anterior shield. The genital lobe of the male is subquadratic. The wings are hyaline with black veins, a yellow pterostigma, and a golden basal spot on the hind wing, sometimes becoming brownish at the base. The posterior ventral margin of the eighth abdominal segment of the female has a short vulvar lamina with swollen processes on each side (**Fig. 3.2.349**). Total length of the female: c. 33 mm. Length of abdomen: 21 to 24 mm. Hind wing length: 26 to 30 mm. The head and thorax are dull olive brown to dark brown with a metallic blue upper frons and vertex and black antennae. The margin of the mentum of the female and the entire mentum of the male is black. The dorsal surface of the abdomen is golden brown. The female abdomen is uniform dull brown without dark markings.

.....*Planiplax phoenicura* Selys in Ris, 1912
(Central America, Trinidad, Venezuela, Guyana, French Guiana, Surinam, Minas Gerais, São Paulo, Rio de Janeiro).

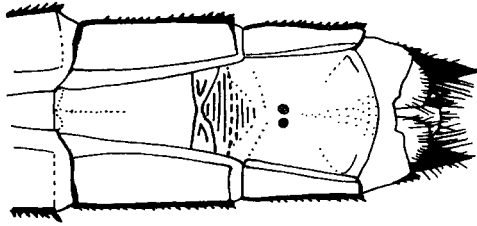


Fig. 3.2.348 Apex of the abdomen of a female *Planiplax arachne* in ventral view. Based on Geijskes (1964a).

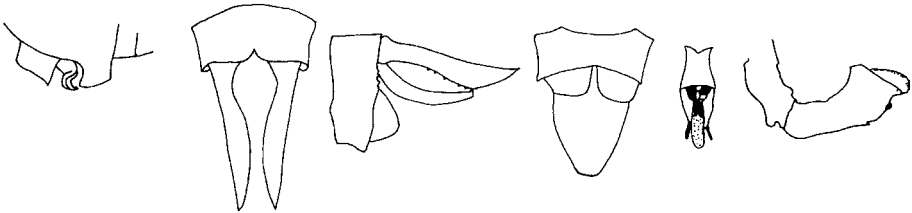


Fig. 3.2.349 *Planiplax phoenicura* male (left to right): the genitalia on the second abdominal segment in lateral view, superior anal appendages in dorsal view, apex of the abdomen in lateral view, the ventral anal appendage in ventral view, and the penis in ventral and lateral view. Based on Santos (1949a).

Key to the adult *Brachymesia* species in Soth America

Information for the key was provided by Needham *et al.* (2000). A key to the larvae has not yet been prepared.

1. The wings are hyaline with brown veins. The pterostigma of the fore-wing is blackish, and that of the hind wing is clouded whitish and bordered by black (**Fig. 3.2.95**). The male is bright red with dark brown or black legs, except at the base of each femur. The posterior part of the head is orange. The compound eyes of the male are olive greenish with some orange markings. The females are almost entirely dull reddish brown with a narrow blackish lateral stripe along the third through seventh abdominal segments and some black on the apical portions of the legs. Male chromosome number: $2n = 25$, $n = 13$ (Ferreira *et al.*, 1979).

.....*Brachymesia furcata* (Hagen, 1861)
(Central America, West Indies, Colombia, Ecuador, Peru, Venezuela, French Guiana, Surinam, Bolivia, Paraguay, Chile, Argentina, São Paulo, Rio de Janeiro). Syn: *Erythemis furcata* Hagen, 1861; *Cannacria smithii* Kirby, 1894; *Brachymesia australis* Kirby, 1889.

- Each wing is heavily stained with amber along the anterior costal margin, across the central part, and at the apex. The veins are brown, and the pterostigmas are cloudy white or brown with darker margins. The head is yellow with dark brown markings. The thorax is dark yellow with a greenish tinge and densely covered by hair-like setae. The abdomen is brownish yellow with broad blackish brown markings along the dorsal midline, which contrast more strongly in the male.

.....*Brachymesia herbida* (Gundlach, 1889)
(North and Central America, West Indies, Colombia, Ecuador, Peru, Venezuela, Guyana, Surinam, French Guiana, Bolivia, Paraguay, Argentina, Mato Grosso, Mato Grosso do Sul, São Paulo, Rio de Janeiro). Syn: *Libellula herbida* Gundlach, 1889; *Cannacria batesii* Kirby, 1889; *Cannacria fumipennis* Currie, 1901.

Key to the adult *Miathyria* species in South America

Information for the key was provided by Pastor (1968).

1. The frons of the male changes from olive in immature adults to metallic violet in mature specimens. The radial space of the fore-wing consists of 5 to 7 cells (**Fig. 3.2.94**). The head and thorax are mainly dark brown. The abdomen is light brown with blackish stripes on the apical segments and yellow anal appendages. Total length: 35 to 38 mm. Length of abdomen: 23 to 26 mm. Hind wing length: 30 to 33 mm. Male chromosome number: $2n = 25$, $n = 13$ (Ferreira *et al.*, 1979).

.....*Miathyria marcella* (Selys in Sagra, 1857)
(Central America, West Indies, Colombia, Ecuador, Peru, Venezuela, Guyana, French Guiana, Bolivia, Paraguay, Argentina, Uruguay, Rio de Janeiro, São

Paulo, Mato Grosso do Sul, Mato Grosso). Syn: *Libellula marcella* Selys in Sagra, 1857.

- The frons of the male is red. The radial space of the fore-wing consists of 3 or 4 cells. The male is dull red on the head and thorax, and the abdomen is bright red with a black dorsal marking on the fourth through seventh segments. The compound eyes of the male are cream colored. The head and thorax of the female are light brown with light reddish brown lateral markings on the thorax. The abdomen of the female is blackish with yellow lateral markings and with a midventral ridge on the ninth abdominal segment (**Fig. 3.2.350**). The wing of the male has a black basal mark and red veins in the proximal parts. The apical part of the wing is hyaline with brown veins. The pterostigma is brown. The wing of the female generally resembles that of the male, but the basal veins are less intense red, and the apical veins are somewhat pale. Total length: c. 32 mm. Length of abdomen: c. 21 mm. Hind wing length: 25 to 27 mm.

.....*Miathyria simplex* (Rambur, 1842)
(Central America, West Indies, Ecuador, Peru, Venezuela, Guyana, French Guiana, Mato Grosso do Sul, São Paulo, Rio de Janeiro). Syn: *Libellula simplex* Rambur, 1842; *Nothifixis laxa* Navás, 1916; *Miathyria pusilla* Kirby, 1889.

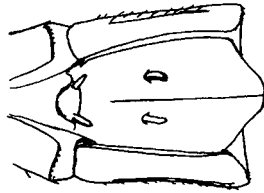


Fig. 3.2.350 Ninth abdominal segment of a female *Miathyria simplex* in ventral view. Based on Needham *et al.* (2000).

Key to the species of *Miathyria* larvae in South America

Information for the key was provided by Costa and Assis (1992).

1. There are six palpal setae. The dorsal spine on the seventh abdominal segment is 2/3 of the middorsal length of the eighth segment; that on the eighth segment extends beyond the posterior margin of the ninth segment (**Fig. 3.2.351**). Total length: 13 to 14 mm.

.....*Miathyria simplex* (Rambur, 1842)
(Central America, West Indies, Ecuador, Peru, Venezuela, Guyana, French Guiana, Mato Grosso do Sul, São Paulo, Rio de Janeiro). Syn: *Libellula simplex* Rambur, 1842; *Nothifixis laxa* Navás, 1916; *Miathyria pusilla* Kirby, 1889.

- There are seven palpal setae. The dorsal spine on the seventh abdominal segment is 1/3 of the middorsal length of the eighth segment; that on the eighth

segment does not extend beyond the posterior margin of the ninth segment (**Fig. 3.2.135**). Total length: 16 to 17.5 mm.

.....*Miathyria marcella* (Selys in Sagra, 1857)
(Central America, West Indies, Colombia, Ecuador, Peru, Venezuela, Guyana, French Guiana, Bolivia, Paraguay, Argentina, Uruguay, Rio de Janeiro, São Paulo, Mato Grosso do Sul, Mato Grosso). Syn: *Libellula marcella* Selys in Sagra, 1857.

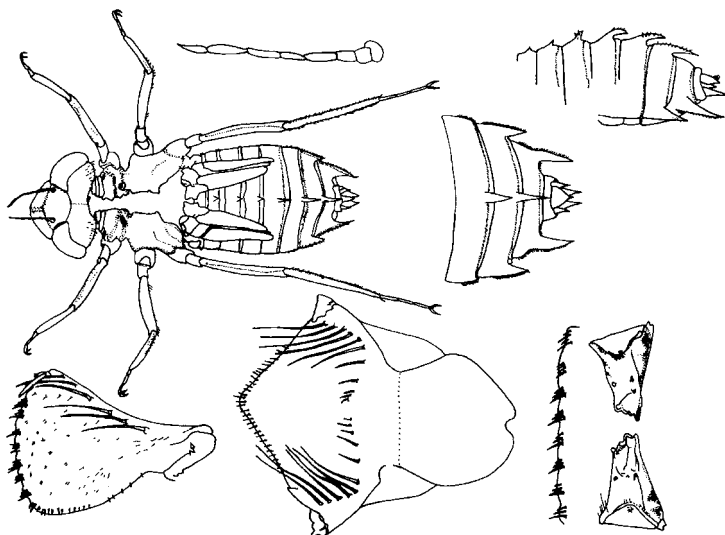


Fig. 3.2.351 *Miathyria simplex* larva: habitus of an exuvia (upper left), antenna (upper left center), mandibles (lower right), labial palp (lower left), prementum in dorsal view (lower center), outline of the inner margin of the labial palp (lower right center), outline of the abdomen in lateral view (upper right), and apex of the abdomen in dorsal view (middle right). Based on Costa and Assis (1992).

Key to the adult *Idiataphe* species in South America

Information for the key was provided by Rácenis (1969).

1. The entire labium is dark brown or black. The anterior lobe on the hamule is almost half as long as the main, posterior part (**Fig. 3.2.352**). Abdomen length: c. 21 to 22 mm; hind wing length: c. 23 mm.

.....*Idiataphe batesi* (Ris, 1913)
(Venezuela, Guyana, Pará). Syn: *Ephidatia batesi* Ris, 1913.

- The labium is mainly orange or yellow, but the median lobe is sometimes black. The anterior lobe on the hamule is a short hook, much shorter than half the length of the main part (**Fig. 3.2.353**).2

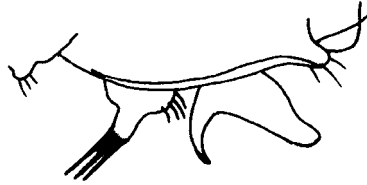


Fig. 3.2.352 Male genitalia on the second abdominal segment of *Idiataphe batesi* in lateral view. Based on Rácenis (1969).

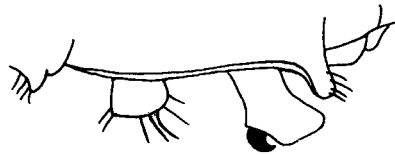


Fig. 3.2.353 Male genitalia on the second abdominal segment of *Idiataphe longipes* in lateral view. Based on Rácenis (1969).

2. The head is orange or yellow on the frons and vertex. The wings are yellowish. In lateral view, the hamule of the male genitalia is clearly longer than the genital lobe (**Fig. 3.2.353**). There are four rows of cells in the anal field of the hind wing, and in the fore-wing, there are $7\frac{1}{2}$ or $8\frac{1}{2}$ antenodal and 6 postnodal cells. Abdomen length: 25 to 28 mm; hind wing length: 30 to 31 mm.

.....*Idiataphe longipes* (Hagen, 1861)
(Colombia, Peru, Venezuela, Guyana, French Guiana, Paraguay, Minas Gerais, São Paulo, Rio de Janeiro, Espírito Santo, Pará?). Syn: *Ephidatia longipes* Hagen, 1861.

- The frons and vertex of the head is metallic violet or bluish, entirely in the male but limited to the dorsal part of the frons and a circle around the vertex in the female.

3. There are three rows of cells in the anal field of the hind wing, and the fore-wing usually has $6\frac{1}{2}$ antenodal and 5 postnodal cross veins. The general color is mainly blackish with narrow dark reddish brown lateral stripes on the thorax of the male and an extensive reddish brown area on the lateral surface of the female thorax. There are also brownish areas on the head and small reddish brown markings on the abdomen of the female. There is usually a small amber mark at the bases of the wings, which are otherwise usually hyaline or slightly yellow-tinged with reddish veins and yellowish to light brown pterostigmas. In lateral

view, the hamule of the male genitalia appears about as long as the genital lobe (Fig. 3.2.101). Abdomen length: 21 to 25 mm; hind wing length: 24 to 28 mm.

.....*Idiataphe amazonica* (Kirby, 1889)
(Central America, Trinidad, Colombia, Peru, Venezuela, Guyana, French Guiana, Bolivia, Amazonas, Pará, São Paulo). Syn: *Ephidatia amazonica* Kirby, 1889; *Ephidatia longipes cubensis* Muttkowski, 1910 pars.

- There are four rows of cells in the anal field of the hind wing, and the forewing usually has $7\frac{1}{2}$ antenodal and 6 postnodal cross veins (Fig. 3.2.354). The labium is entirely yellow. The dark marking at the base of the wing is blackish in the male and yellow in the female. The male is usually extensively pale on the proximal abdominal segments, while the female abdomen is pale except for the tenth segment. Abdomen length of male: 24 to 26 mm; female: 22 to 23 mm. Hind wing length: 27 to 29 mm.

.....*Idiataphe cubensis* (Scudder, 1866)
(North and Central America, West Indies, not reported from South America). Syn: *Macromia cubensis* Scudder, 1866; *Erythemis specularis* (Hagen, 1867); *Erythemis longipes* var. *specularis* Hagen (1867); *Erythemis longipes* form? *cubensis* Calvert (1906).



Fig. 3.2.354 *Idiataphe cubensis*: lateral view of male genitalia on the second abdominal segment. Based on Rácinis (1969).

Key to the species of adult *Brechmorhoga* in South America

Information for the key was provided by Calvert (1898), Ris (1913), Navás (1916a), Santos (1946f, g), Rácinis (1954), and DeMarmels (1989a). Some of the characteristics apply only to the male, and some females cannot be distinguished with certainty. There are unpublished opinions that several *Macrothemis* species must be transferred to this genus, and *Macrothemis valida* Navás, 1916, already appears in species lists under the name of *Brechmorhoga valida* (Navás, 1916). However, a published revision of the two genera will be necessary to resolve this problem, and for the sake of accuracy, the keys to both genera should be used for doubtful specimens.

1. In the hind wing of the male, the posttrigonal cells, that is, those running from the distal side of the triangle to the posterior margin of the wing, form a single row from the triangle for a length of at least three cells before forming two or more rows of cells. The apical section of the hamule extends farther ventrad than the anterior lamina (Fig. 3.2.355).2

- Starting at the triangle in the hind wing of the male, the posttrigonal cells form two rows, or there is a single cell bordering on the triangle followed immediately by two rows. The genital lobe and anterior lamina are about equal in size (**Fig. 3.2.356**). Laterally, the coloration of the thorax is predominantly dark brown or black. The labrum is mainly yellow.4

2. The male has three cell rows running from the second anal vein, A_2 , to the posterior margin of the wing. The triangle in the fore-wing is crossed. The genital lobe and anterior lamina extend ventrad about the same distance, and the genital lobe is perpendicular to the body axis (**Fig. 3.2.355**). The hind femur has 15 to 26 teeth. Abdomen length of male: c. 29 mm; female: c. 32 mm. Hind wing length of male: c. 36 mm; female: c. 39 mm. Color: bright reddish brown on the head, dark brown with greenish stripes on the thorax, and black with yellow markings on the abdomen. The female has a similar coloration, except for the lighter thorax without green stripes. There is a metallic blue marking on the vertex of both males and females.

.....*Brechmorhoga flavopunctata* (Martin, 1897)
(Colombia, Peru, Bolivia). Syn: *Dythemis flavopunctata* Martin, 1897;
Brechmorhoga flavoannulata Lacroix, 1920.

- The male has two cell rows, and the female three or four rows running from the second anal vein to the posterior margin of the wing. Usually, the triangle in the fore-wing is not crossed. The anterior lamina extends farther ventrad than the genital lobe (**Fig. 3.2.357**).3

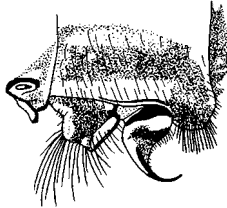


Fig. 3.2.355 Male genitalia on the second abdominal segment of *Brechmorhoga flavopunctata* in lateral view. Based on Ris (1911b).

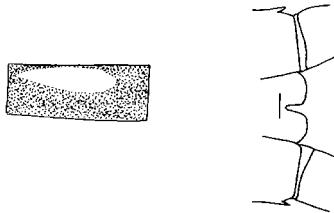


Fig. 3.2.356 *Brechmorhoga praecox* female: color pattern on one side of the seventh abdominal segment in dorsal view (left) and the vulvar lamina at the junction of the eighth and ninth abdominal segments, seen in ventral view (right). Based on Calvert (1898).

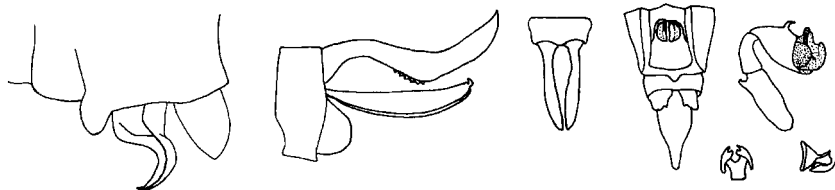


Fig. 3.2.357 *Brechmorhoga travassosi* (left to right): genital structures on the second segment; apex of the abdomen in lateral view, with the superior appendages in dorsal view, and in ventral view; penis in lateral view (above), and its median process in posterior and lateral view (below, left and right, respectively). Based on Santos (1946f).

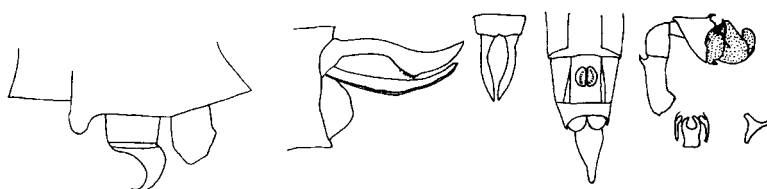


Fig. 3.2.358 *Brechmorhoga nubecula* (left to right): genital structures on the second segment; apex of the abdomen in lateral view, with the superior appendages in dorsal view, and in ventral view; penis in lateral view (above), and its median process in posterior and lateral view (below, left and right, respectively). Based on Santos (1946f).

3. The superior anal appendages run closely together and are parallel or slightly convergent from the base to the apex. Usually the triangle in the fore-wing is not crossed. The hind femur has 5 to 10 teeth arranged along a ridge somewhat distal of midlength. In lateral view, the superior anal appendage appears strongly sigmoid with the group of ventral teeth located at about its midlength (**Fig. 3.2.357**). Abdomen length: 37 to 38 mm. Hind wing length: 35 to 36 mm. The head and thorax are mainly ferrugineous with yellow and brown markings, while the abdomen is mainly black with large yellow or greenish bands across the second through eighth segments and a greenish first segment. The female has not been described.

.....*Brechmorhoga travassosi* Santos, 1946
(French Guiana, Rio de Janeiro).

- The superior anal appendages diverge over the basal 1/3 and converge over the apical 2/3. The hind femur has 4 or 5 strong teeth on the ventral margin. The supraanal tubercle is large, triangular, chitinized, shiny, and somewhat curved ventrad. The genital lobe is half the size of the anterior lamina or smaller, and the hamule is continually curved as far as its acute apex (**Fig. 3.2.358**).

Laterally, the coloration of the thorax is predominantly pale blue or green. The labium is mainly pale in color.

.....*Brechmorhoga nubecula* (Rambur, 1842)
(Central America, Trinidad, Venezuela, Colombia, Ecuador, Peru, Argentina, Paraguay, Mato Grosso, São Paulo, Rio de Janeiro). Syn: *Libellula nubecula* Rambur, 1842; *Macrothemis catharina* Karsch, 1890.

4. At the arculus and at the nodus, the hind wing is 8.5 to 10 mm wide. The abdomen of the male is longer than the hind wing. Between the sub-basal sector, vein A_3 according to Calvert (1906), and the proximal hind wing margin posterior the membranule, there are two rows of cells in the male and two or three rows in the female.5

- At the arculus, the hind wing is 10.5 mm to about 13 mm wide, but at the nodus, its width is 10 to 12 mm. There is no posterior process on the genital lobe of the male (**Fig. 3.2.359**). Between the sub-basal sector, vein A_3 according to Calvert (1906), and the proximal hind wing margin posterior the membranule, there are three cell rows in the male and three or four in the female.7

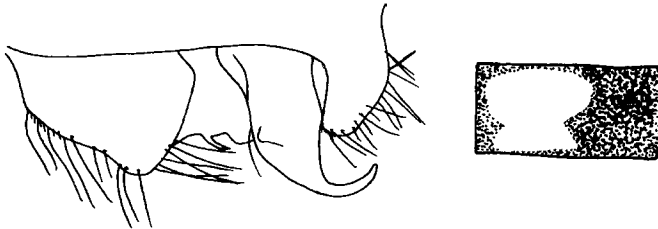


Fig. 3.2.359 *Brechmorhoga rapax* male: genitalia on the second abdominal segment in lateral view (left) and the color pattern on one side of the seventh abdominal segment in dorsal view (right). Based on Calvert (1898).

5. The green longitudinal stripes on each side of the third abdominal segment are not continuous with the green, transverse band at the base of the segment. The labrum usually has a brown or black margin. The hamule is strongly curved for its entire length and has a blunt apex, and there is no posterior process on the genital lobe. The dorsal, anterior, and lateral parts of the frons are metallic blue. The lobes of the vulvar lamina on the ninth abdominal segment of the female are shorter than the width of the space between them. Length of abdomen: 36 to 40 mm. Hind wing length: 32 to 38 mm.

.....*Brechmorhoga vivax* Calvert, 1906
(Central America, Peru, Venezuela, Argentina).

- The green longitudinal stripes on each side of the third abdominal segment are continuous with the green, transverse band at the base of the segment.6

6. The labrum is almost entirely yellow. The hamule is straight near its midlength and curved near its acutely pointed apex. Only the dorsal and anterior parts of the frons are metallic blue. The lobes of the vulvar lamina on the ninth

abdominal segment of the female are longer than the width of the space between them (**Fig. 3.2.356**). Length of abdomen: 36 to 40 mm. Hind wing length: 31 to 36 mm.

.....*Brechmorhoga praecox* (Hagen, 1861)
(Mexico, Central America, West Indies, Colombia, Peru, Venezuela, Brazil).
Syn: *Dythemis praecox* Hagen, 1861. Three subspecies have been described:
Brechmorhoga praecox praecox (Hagen, 1861); *Brechmorhoga praecox*
grenadensis Kirby, 1894; and *Brechmorhoga praecox postlobata* Calvert, 1898.

- The labrum is yellow with a brown spot in the middle and one near each lateral margin. The genital lobe is rounded. The hamule is continually curved as far as its apex. In dorsal view, the bases of the superior anal appendages are nearly parallel, and the apical sections are convergent (**Fig. 3.2.360**). Hind wing length: 30 to 33 mm. Length of abdomen without appendages: 34 to 37 mm. Length of superior anal appendage: c. 2.5 mm. The female has not been described.

.....*Brechmorhoga praedatrix* Calvert, 1909
(Trinidad, Venezuela, French Guiana, Argentina, Mato Grosso, São Paulo, Rio de Janeiro).

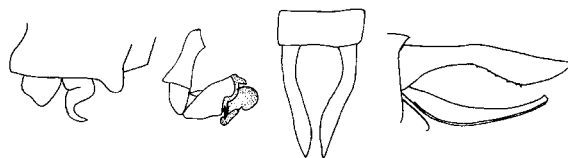


Fig. 3.2.360 *Brechmorhoga praedatrix* male (left to right): genitalia on the second abdominal segment, penis in lateral view, apex of the abdomen in dorsal and lateral view. Based on Santos (1946g).

7. In lateral view, the genital lobe on the second abdominal segment of the male is produced anteriorly; it thus extends along the longitudinal axis of the abdomen more than twice its height, permitting the hamule and anterior lamina to extend far below it. The inner margin of the hamule is somewhat angled at its midlength, while the outer margin is evenly curved along its apical half. The inferior anal appendage is as long as or slightly longer than the superior appendage. The labium and labrum are almost entirely black with brown only at the lateral margin of the labium, slightly more extensive in the female, and two small yellow basal spots near the center of the labrum. The triangle is crossed in the fore-wing and free in the hind wing. There are $12\frac{1}{2}$ or $13\frac{1}{2}$ antenodal cross veins and 20 to 28 cells in the anal loop of the hind wing. The apical segments of the abdomen are not notably enlarged. Total length of the male without appendages: c. 47 mm. Length of male abdomen without appendages: 31 to 33 mm; female: 35 to 37 mm. Hind wing length of male: 34.5 to 35.5; female: 36 to 39 mm. The frons, vertex, and occipital triangle are metallic bluish black. The

thorax is dark brown with light greenish markings, and the abdomen is black with greenish yellow markings. The dorsal markings in the pair on the seventh abdominal segment cover more than half of the dorsal surface (**Fig. 3.2.102**).

.....*Brechmorhoga neblinae* DeMarmels, 1989
(Venezuela).

- In lateral view, the genital lobe is not produced anteriorly and usually extends as far or farther below the abdomen than its length along the longitudinal axis of the abdomen. The inner margin of the hamule is nearly straight or evenly curved at its midlength (**Fig. 3.2.359**). In case of doubt, the labium and labrum are not almost entirely black with brown only at the lateral margin of the labium and two small yellow basal spots near the center of the labrum.8
8. The inner margin of the hamule curves uniformly from its base or midlength, and the apex is acutely pointed (**Fig. 3.2.359**).9
- The hamule is straight near its midlength, where it curves sharply and then straightens somewhat before reaching its somewhat blunt or truncate apex (**Fig. 3.2.361**). The hind wing is considerably wider across the arculus than across the nodus.11

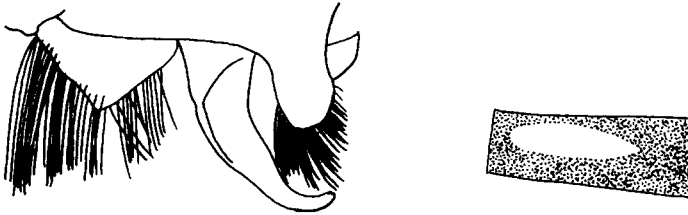


Fig. 3.2.361 *Brechmorhoga pertinax* male: genitalia on the second abdominal segment in lateral view (left) and the color pattern on one side of the seventh abdominal segment in dorsal view (right). Based on Calvert (1898).

9. The seventh through ninth abdominal segments of both sexes are greatly widened. There are two pale lateral stripes on each side of the fourth through seventh abdominal segments. The labium is entirely yellow. The hamule resembles that of *B. rapax* but is said to be smaller. The vulvar lamina is also small, consisting of two blunt triangular lobes separated by an incision in the form of an evenly curved arc. Length of abdomen: 37 to 39 mm. Hind wing length: 39 to 41 mm.

.....*Brechmorhoga diplosema* Ris, 1913
(Rio de Janeiro). The validity of this species, which closely resembles *B. rapax*, is open to question.

- The seventh through ninth abdominal segments are not greatly widened. The lobes of the vulvar lamina are shorter than the space between them (**Fig. 3.2.362**).10

10. The supraanal triangle is inconspicuous and not sclerotized. The lateral lobes of the labium are mainly yellowish, but the inner posterior fourth is black. Lateral markings on the middle abdominal segments are not in the form of a double stripe. The dorsal pale spots on each side of the seventh abdominal segment cover most of the width of the segment; each spot is only slightly longer than wide and is more orange than green (**Fig. 3.2.359**).

.....*Brechmorhoga rapax* Calvert, 1898 (Central America, Ecuador, Colombia, Venezuela). Syn: *Nothemis apollinaris* Navás, 1915. Two subspecies have been described: *Brechmorhoga rapax rapax* Calvert, 1898; and *Brechmorhoga rapax crocosema* Ris, 1913.

- There is a distinctively-formed, sclerotized supraanal tubercle on the female that is somewhat shiny black, bilobed, and armed with black setae at the apex (**Fig. 3.2.362**). The labium of the female is dark reddish with a blackened median lobe. There are pale lateral markings, probably yellow, on the third through seventh abdominal segments. The dorsal pale spots on the seventh abdominal segment are rounded and cover much of the surface of the segment. Length of female abdomen: c. 35 mm. Hind wing length of female: c. 44 mm. Length of pterostigma: c. 4 mm. The male has not been described.

.....*Brechmorhoga innupta* Rácinis, 1954 (Venezuela). The validity of this species must be confirmed with a description of a male specimen.

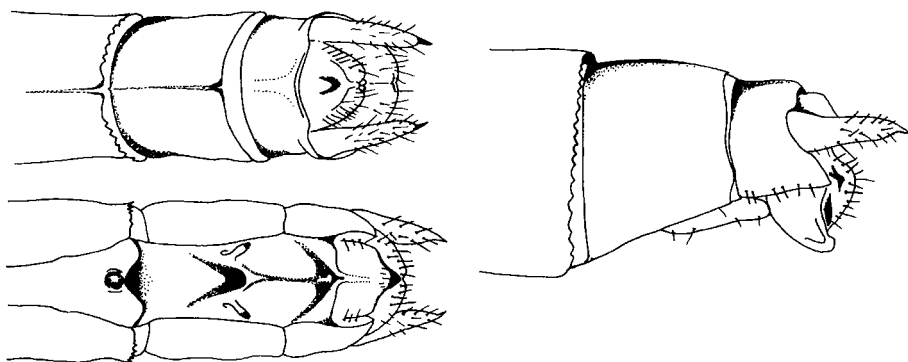


Fig. 3.2.362 *Brechmorhoga innupta* female: apex of the abdomen in dorsal (upper left), ventral (lower left), and lateral view (right). Based on Rácinis (1954).

11. The hind wing is only slightly wider across the arculus than across the nodus. There are only two broad lateral stripes on the thorax. The genital lobe of the male is rectangular. The inner margin of the hamule curves evenly from about its midlength. In dorsal view, the bases of the superior anal appendage are divergent, and the apical sections curve strongly and become convergent at the

apex (**Fig. 3.2.363**). The lobes of the vulvar lamina are short, wide, and partially separated by a small triangular median emargination, slightly deeper than wide. Hind wing length: 38 to 40 mm. Length of abdomen without appendages: c. 34 mm. Length of superior anal appendage: c. 2 mm.

.....*Brechmorhoga tepeaca* Calvert, 1908
(Central America, Rio de Janeiro, São Paulo). Syn: *Brechmorhoga tepeacea*, spelling by Santos (1946g).

- The hind wing is considerably wider across the arculus than across the nodus. The entire outer surface of the hamule is almost evenly curved, while the inner margin straightens somewhat at midlength. There is a greenish yellow pair of spots on the seventh abdominal segment (**Fig. 3.2.361**). The vulvar lamina is divided into two separate lobes by a triangular emargination that reaches to the anterior margin of the ninth segment of the female.

.....*Brechmorhoga pertinax* (Hagen, 1861)
(Central America, Colombia, Peru, Bolivia). Syn: *Dythemis pertinax* Hagen, 1861; *Libellula (Dythemis) sallaei* (Selys, 1868). Three subspecies have been described: *Brechmorhoga pertinax pertinax* (Hagen, 1861), *Brechmorhoga pertinax eurysema* Ris, 1913, and *Brechmorhoga pertinax peruviana* Ris, 1913.

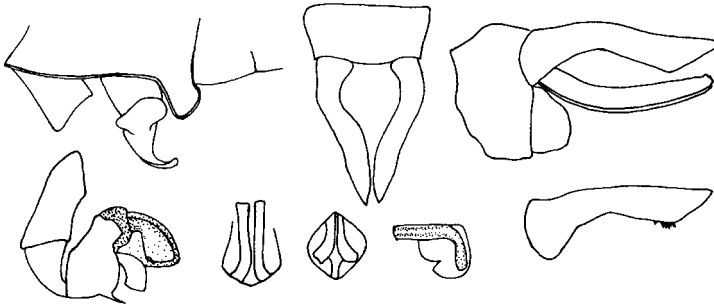


Fig. 3.2.363 *Brechmorhoga tepeaca* male (above, left to right): genitalia on the second abdominal segment and apex of the abdomen in dorsal and lateral view, and (below, left to right): penis in lateral view, median process of the penis in dorsal, apical, and lateral view, and the superior anal appendage in lateral view. Based on Santos (1946g).

Key to the species of *Brechmorhoga* larvae in South America

Information for the key was provided by DeMarmels (1982a), Santos (1969b), and Santos and Costa (1999). Few larvae in this genus have been described.

1. There are five to seven spine-like setae along the anterior margin of the prementum near the base of the articulation with the lateral lobe. There are 11 to 13 premental setae (**Fig. 3.2.364**).2

- There are no spine-like setae along the anterior margin of the prementum near the base of the articulation with the lateral lobe. There are 8 to 16 premental setae (**Fig. 3.2.365**).3

2. In lateral view, hook-like mid-dorsal processes are evident only on the second through fifth abdominal segments. Those on the posterior segments are vestigial. There are 12 or 13 premental setae, 4 spine-like setae at the base of the lateral lobes, and 5 to 7 along the anterior margin of the prementum near the base of the articulation with the lateral lobe. The projection of the prothorax dorsal to the fore-coxa bears a distinct anterior lobe and lacks a distinct tubercle-like projection in the middle. The wing buds reach the fifth abdominal segment (**Fig. 3.2.18**). Total length of final instar: c. 21 to 22 mm.

.....*Brechmorhoga vivax* Calvert, 1906
(Central America, Peru, Venezuela, Argentina).

- In lateral view, hook-like mid-dorsal processes are evident on the second through ninth abdominal segments. There are 11 premental setae, 2 spine-like setae at the base of the lateral lobes, and 5 or 6 along the anterior margin of the prementum near the base of the articulation with the lateral lobe. The wing buds reach the mid-length of the sixth abdominal segment (**Fig. 3.2.364**). Total length of final instar: c. 20 mm.

.....*Brechmorhoga travassosi* Santos, 1946
(French Guiana, Rio de Janeiro).

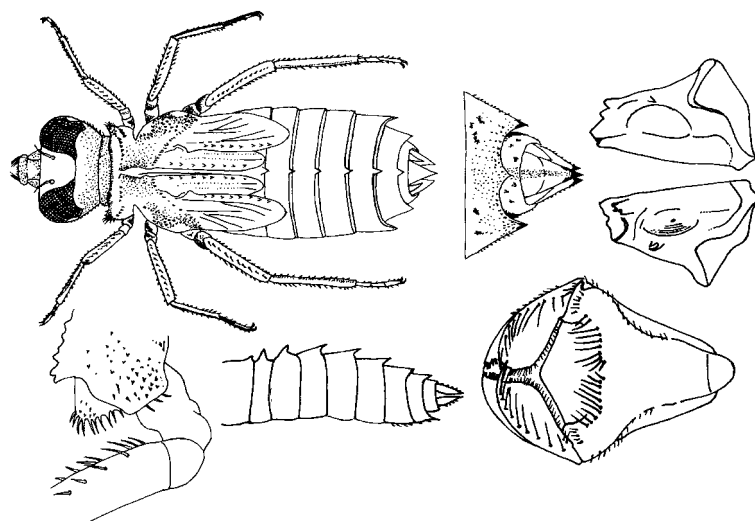


Fig. 3.2.364 *Brechmorhoga travassosi* larva: habitus from an exuvia (upper left), apophyses of the prothorax (lower left), labium (lower right), mandibles (upper right), outline of the abdomen in lateral view (lower center), and the apex of the abdomen in dorsal view (upper right center). Based on Santos and Costa (1999).

3. There are 11 to 16 premental setae, 6 to 10 spine-like setae at the base of the lateral lobes, and none along the anterior margin of the prementum near the base of the articulation with the lateral lobe. The projection of the prothorax dorsal to the fore-coxa bears a tubercle-like projection in the middle and a less developed, triangular anterior part. The wing buds reach the posterior part of the fifth abdominal segment (**Fig. 3.2.365**). Total length of final instar: c. 21.5 to 24.5 mm.

.....*Brechmorhoga rapax* Calvert, 1898 (Central America, Ecuador, Colombia, Venezuela). Syn: *Nothemis apollinaris* Navás, 1915. Two subspecies have been described: *Brechmorhoga rapax rapax* Calvert, 1898; and *Brechmorhoga rapax crocosema* Ris, 1913.

- There are 8 premental setae, 2 spine-like setae at the base of the lateral lobes, and none along the anterior margin of the prementum near the base of the articulation with the lateral lobe. The wing buds reach the fifth abdominal segment. Total length of final instar: c. 22 mm.

.....*Brechmorhoga nubecula* (Rambur, 1842) (Central America, Trinidad, Venezuela, Colombia, Ecuador, Peru, Argentina, Paraguay, Mato Grosso, São Paulo, Rio de Janeiro). Syn: *Libellula nubecula* Rambur, 1842; *Macrothemis catharina* Karsch, 1890.



Fig. 3.2.365 *Brechmorhoga rapax* larva: antenna (left); part of the labium with one labial palp (left center); lateral projection of the prothorax with the coxa, trochanter, and base of the femur in dorsal view (upper right); lateral profile of the abdomen (lower right). Based on DeMarmels (1982a).

Key to the species of adult *Gynothemis* in South America

Information for the key was provided by Ris (1913a), Navás (1933a), and Geijskes (1972). The larvae of most species have not been described.

1. The hind wing of the female is at least about 26 mm long, and the female abdomen is at least 23 mm long. If the hind wing of the female is slightly less than 26 mm, then the abdomen is at least 10% shorter than the hind wing.2

- The hind wing of the female is not longer than about 25 mm. If it is slightly longer, then the abdomen is longer than the hind wing.3
 2. The hind wing of the female is about 26 mm long, and the female abdomen is about 23 mm long. The labium of the female is brownish with darker brown areas in the middle and in the centers of the lateral lobes. The rest of the head is mainly yellowish brown. The thorax is light reddish brown. The middle and hind femora are light brown and armed with about nine dark spines, which increase progressively in length apicad. The tibiae are armed with many spines. The wings are hyaline with a black basal spot bordered with yellow on the hind wing that reaches only as far as the first antenodal cross vein. The light brown pterostigma is less than 2 mm. There are 8½ or 9½ antenodal crossveins in the fore-wing. The male has not been described.

.....*Gynothemis calliste* Ris, 1913
 (Minas Gerais).

- The hind wing of the female is about 30 to 31 mm long, and the female abdomen is about 29 to 30 mm long. The head of the female is mainly yellow with yellowish hair-like setae. The thorax is mainly yellow with a greenish tinge dorsally and dark markings. The legs are mainly yellow with black spines, nine spines on the hind femur, which increase progressively in length apicad. The tarsal claw is armed with a small subapical tooth. The wings are hyaline with black veins, a dark basal spot, and a yellow band along the costal, subcostal, and radial spaces (**Fig. 3.2.366**). The abdomen is cylindrical and enlarged at its base. The ferruginous pterostigma is about 3.2 mm long. The male has not been described.

.....*Gynothemis aurea* Navás, 1933
 (Rio de Janeiro).

3. The hind femur of the male bears one long seta instead of a row of spines. The abdomen of the female is about 15.5 mm long, and that of the male is about 16 mm. There are no dark basal spots on the wings. The head of the female, including the mouth parts, is almost entirely creamy yellow with a metallic bluish black spot on the vertex, dorsal part of the frons, and along the deep median groove on the ventral part of the frons, as well as black on the antennae and posterior to the eyes and brown on the occipital triangle. The thorax is dark brown and black with wide yellow stripes. The abdomen of the female is black with yellow lateral stripes on the first through fifth segments and lateral spots on the sixth and seventh. There are 11½ antenodal cross veins in the fore-wing. The superior anal appendages of the male are about as long as the combined length of the ninth and tenth segments and only slightly longer than the inferior appendage (**Fig. 3.2.367**). Total length: c. 23 mm. Hind wing length: 21 to 21.5 mm. Length of pterostigma: c. 1.5 mm.

.....*Gynothemis uniseta* Geijskes, 1972
 (French Guiana, Surinam).

- The hind femur of the male bears a row of at least five spines. The abdomen of the female is at least about 17 mm long. The basal spot in the hind wing reaches at least as far as the second antenodal cross vein (**Fig. 3.2.100**).4

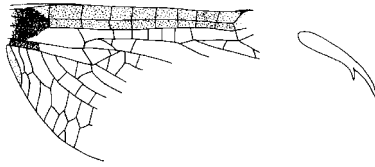


Fig. 3.2.366 *Gynothemis aurea* female: base of the hind wing (left) and a tarsal claw (right). Based on Navás (1933a).

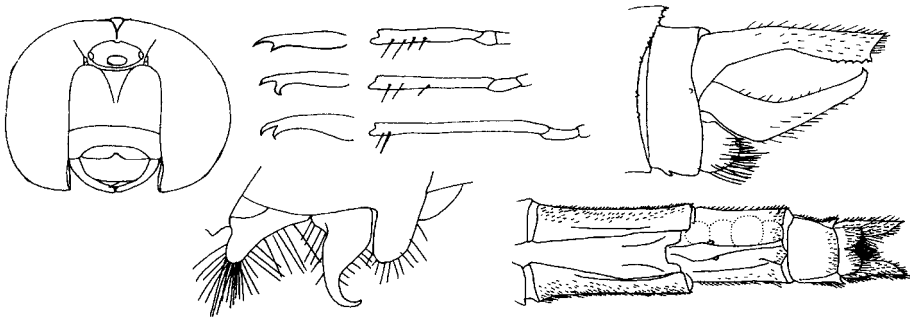


Fig. 3.2.367 *Gynothemis uniseta*: head of a female in anterior view (left); male genitalia on the second abdominal segment in lateral view (lower center); claws on the fore, middle, and hind tarsi of a male (upper left center, top to bottom, respectively); fore, middle, and hind femur of a male (upper right center, top to bottom, respectively); apex of the male abdomen in lateral view (upper right), and the apical segments of a female abdomen in ventral view (lower right). Based on Geijskes (1972).

4. The hind femur of the male bears a row of about 5 short, triangular spines. The hind wing of the male is about 19 mm and that of the female is about 20 mm long. The female abdomen is about 17 mm long. The labium of the female is yellow with a narrow brown border and middle lobe. The rest of the head is mainly yellow. The thorax is greenish brown with vague markings. The wings are hyaline with a yellow basal spot on the hind wing that reaches as far as the fifth antenodal cross vein and the triangle. The pterostigma is yellow with dark margins and very small. There are $8\frac{1}{2}$ or $9\frac{1}{2}$ antenodal crossveins.

.....*Gynothemis venipunctata* Calvert, 1909
(Venezuela, São Paulo, Mato Grosso).

- The hind femur of the male bears a row of about 16 to 18 short, triangular spines. The hind wing of the male is about 22 mm and that of the female is about 24 mm long. The abdomen of both sexes is about 25 mm long. The basal spot in the fore-wing reaches as far as the second, and that in the hind wing, to the second or third antenodal cross vein and the second or third cell in the anal field. The pterostigma is longer than 2 mm. There are $10\frac{1}{2}$ or $11\frac{1}{2}$ antenodal crossveins (**Fig. 3.2.100**).

.....*Gynothemis heteronycha* (Calvert, 1909)
(Paraguay, Argentina, São Paulo, Mato Grosso). Syn: *Brechmorhoga heteronycha* Calvert, 1909; *Ophippus garbei* Navás, 1916.

Key to the species of adult *Macrothemis* in South America

Information for the key was provided by Kirby (1897), Calvert (1898, 1909b), Ris (1913a), Rácenis (1957), Santos (1946h, 1967f), Belle (1983a, 1987a), and Costa (1990, 1991). The females of all species have not been described. A problematic species, named *Macrothemis valida* by Navás (1916a), is considered to be species of *Brechmorhoga* by many specialists, and a revision of these two genera may result in the transfer of additional species, raising the question of whether these two genera are really distinct. In spite of the attempts by Donnelly (1984) to better define the two genera, doubts persist.

1. The abdomen of the male is usually longer than 40 mm.2
- The abdomen is never much longer than 35 mm.3

2. The abdomen of the male is about 40.5 mm long. The hind wing length of the male is about 34.5 mm. The superior anal appendage of the male is rounded at the apex and has a ventral tooth $\frac{3}{4}$ of the way from the base to the apex. The color of the thorax is light olive green with black lines along the lateral sutures.

.....*Macrothemis lutea* Calvert, 1909
(Sergipe).

- The abdomen of the male and female is about 43 mm long. The hind wing length of the male is about 36 mm, and that of the female is about 40 mm. The pterostigma is about 2 mm long. The superior anal appendage of the male is blunt at the apex. The color is dull olive green with darker markings. The male abdomen is thin and cylindrical without widening of the apical segments.

.....*Macrothemis lauriana* Ris, 1913
(Peru, Paraguay, Mato Grosso do Sul).

3. The tarsal claws on the hind legs differ from those on the other legs in being asymmetrical or absent (**Fig. 3.2.368**).4

- The claws on the hind tarsi are similar to those on the other legs and are symmetrical with regard to the subapical tooth on its claws (**Fig. 3.2.369**).5

4. The tarsal claw on the hind leg lacks a subapical tooth, while a tooth is present on the fore and middle tarsal claws; that on the fore leg is as large as the apical part of the claw, and that on the middle, somewhat larger. The wings are

tinged golden yellow only near the base; the membranule is dark gray. There are $9\frac{1}{2}$ or $10\frac{1}{2}$ antenodal cross veins. The abdomen is black along the mid-dorsal and transverse carinae with large yellow patches on the third through eighth segments. A second yellow patch is oriented parallel to the first on the second through fifth segments. On the ninth and tenth segments, the yellow patches are small and irregular. The superior anal appendage curves obliquely dorsad at the apex (**Fig. 3.2.370**). Length of abdomen: 22 mm. Length of hind wing: 23 mm. Length of pterostigma: 1.5 mm. The female has not been described. Santos (1967f) was not sure that the claw on the hind leg of his specimen did not result from a malformation, so compare other features of specimens to be identified with the description and figures provided.

.....*Macrothemis hosanae* Santos, 1967
(São Paulo, Goiás, Distrito Federal).

- The claws on the hind tarsi are asymmetrical, with the subapical tooth on the hind claw considerably larger than the apical part of the claw, while the tooth on the anterior claw is equal to or slightly larger than the apical part of the claw. The superior anal appendage of the male is about 1.5 times the length of the inferior appendage (**Fig. 3.2.368**). Total length with appendages: 32 to 34.5 mm. Length of abdomen: c. 23 mm. Hind wing length: 22 to 25 mm. Length of pterostigma of male: 1 mm; female: 1.5 mm. Color: head mainly yellow with a brown labium and a dense covering of long, dark setae on the clypeus, frons, and vertex. The thorax is dark brown with green stripes. The wings are hyaline with golden yellow markings at the base and light brown pterostigmas. The abdomen mainly light brown with black dorsal and lateral stripes.

.....*Macrothemis absimile* Costa, 1991
(Paraná, Goiás, Brasília).

5. The tooth on each tarsal claw is shorter than the apical part of the claw. Each hind femur usually bears a row of strongly curved spines with bases that are roughly quadrangular (**Fig. 3.2.369**).6

- The tooth on the tarsal claw is as long or longer than the apical part of the claw.12

6. The description is of a female. Length of the abdomen is c. 15.5 mm, and the hind wing length is c. 21.5 mm. The length of the pterostigma is about 1.5 mm. The tooth is only very slightly smaller than the apical portion of the tarsal claw. The mouthparts are yellow, and the face is mainly olive. The frons and vertex are marked with yellow, and the dorsal surface of the head is mainly blackish with a bluish metallic sheen in places. The thorax is remarkably small, dark brownish black, and marked with bright yellow. The abdomen is short, cylindrical, and black with yellowish brown markings. There are $11\frac{1}{2}$ or $12\frac{1}{2}$ antenodal cross veins in the fore-wing; the wings are completely hyaline. The pterostigma is black, and the membranule is dark gray. The male has not been described.

.....*Macrothemis idalia* Ris, 1919
(Venezuela, Guyana). Without a description of the male, the status of this species remains doubtful.

- The length of the female abdomen is at least about 18 mm, and the hind wing length of the female is at least about 23 mm.7

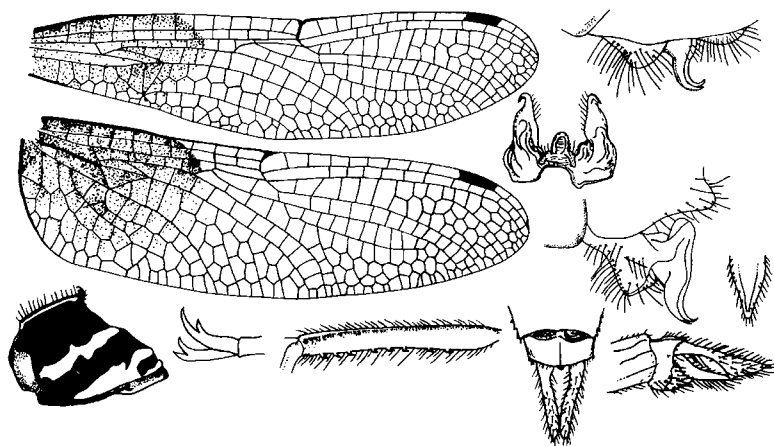


Fig. 3.2.368 *Macrothemis absimile* male: fore and hind wing (upper left), lateral color pattern on the synthorax (lower left), hind tarsal claws (lower left center), hind femur in lateral view (lower left center), hamule in dorsal view (upper middle right), genitalia on the second abdominal segment in lateral view with the hamule retracted (upper right) and extended (middle right), apex of the abdomen in dorsal (lower right center) and lateral view (lower right), and the inferior anal appendage in ventral view (lower middle right). Based on Costa (1991).

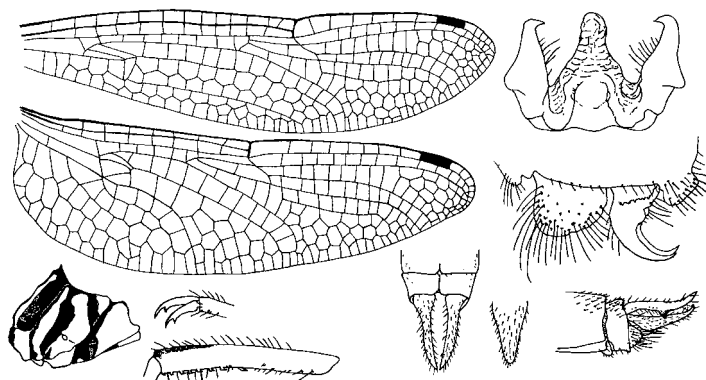


Fig. 3.2.369 *Macrothemis newtoni* male: fore and hind wing (upper left), lateral color pattern on the synthorax (lower left), hind tarsal claws (left center), hind femur in lateral view (lower left center), hamule in posterior view (upper right), genitalia on the second abdominal segment in lateral view (middle right), apex of the abdomen in dorsal (lower center) and lateral view (lower right), inferior anal appendage in ventral view (lower right center). Based on Costa (1990).

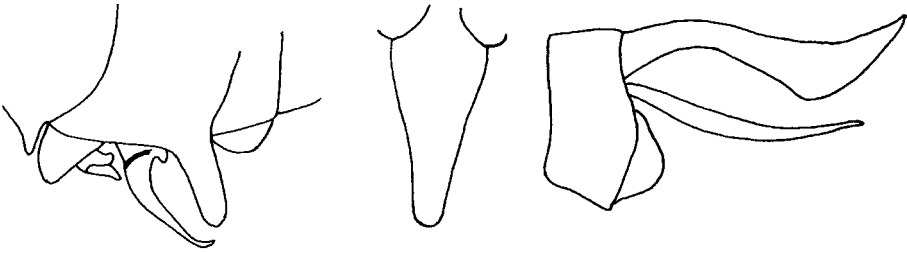


Fig. 3.2.370 *Macrothemis hosanae* male (left to right): lateral view of the genitalia on the second abdominal segment, inferior anal appendage in ventral view, and apex of the abdomen in lateral view. Based on Santos (1967f).

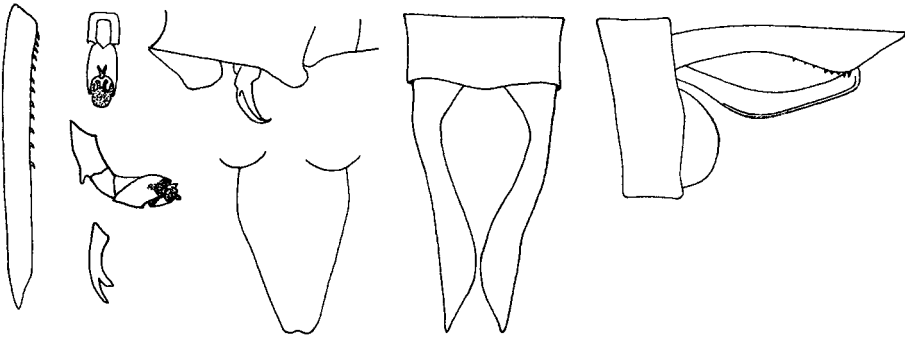


Fig. 3.2.371 *Macrothemis griseofrons* male: hind femur (left), claw on the foretarsus (lower left center), penis in ventral and lateral view (upper and middle left center, respectively), genitalia on the second abdominal segment (upper center), inferior anal appendage in ventral view (lower center), superior anal appendages in dorsal view (right center), and apex of the abdomen in lateral view (right). Based on Santos (1946h).

7. The superior anal appendages of the male are about 1.5 times the length of the inferior anal appendages (**Fig. 3.2.103**). The dorsal surfaces of the lamina supra-analis and the tenth abdominal segment are not hairy. Total length: 30 to 31.5 mm. Length of abdomen including caudal appendages: 22 to 22.5 mm. Hind wing length: 23.5 to 24.5 mm. Length of costal margin of pterostigma: 1.5 to 1.6 mm. Color: Head mainly yellow, metallic green, and black on the anterior surface and yellowish brown on the posterior surface. The thorax and abdomen are mainly dark brown and blackish with greenish and yellowish markings.

.....*Macrothemis brevidens* Belle, 1983
(French Guiana, Surinam).

- The superior anal appendages of the male are much shorter than 1.5 times the length of the inferior anal appendages (**Fig. 3.2.371**). The heads of the known females have bright blue markings on or around the vertex.8
 8. In lateral view, the inferior anal appendage of the male appears about equally wide from the base to the apical 1/5. The hind wing has a post-triangular row of cells one cell wide. The spines on the hind femur have their apices curved strongly to parallel the longitudinal axis of the femur, making them appear rectangular. Total length of the female: c. 35 mm. Length of abdomen: c. 25 mm. Hind wing length: 30 to 31 mm. Length of pterostigma: c. 2.5 mm. The basal portion of the wings of the female are hyaline, and the apical portion from midway between the nodus and dark brown pterostigma is clouded dark brown. The abdomen is black with two pale green spots on the first six segments and one such spot on the seventh.

.....*Macrothemis tessellata* (Burmeister, 1839)
 (Central America, Colombia, Ecuador, Paraguay, Argentina, São Paulo). Syn: *Libellula tessellata* Burmeister, 1839.

- In lateral view, the inferior anal appendage of the male appears to widen to its greatest width in the basal half (**Fig. 3.2.371**).9
 9. In lateral view, the inferior anal appendage appears to widen only slightly and reaches its greatest width at about 2/5 of the distance from the base to the apex, making the dorsal surface of the appendage clearly concave (**Fig. 3.2.371**).10

- In lateral view, the inferior anal appendage widens considerably about 1/3 of the way from the base to the apex, resulting in the dorsal surface of the appendage appearing only slightly concave (**Fig. 3.2.369**).11

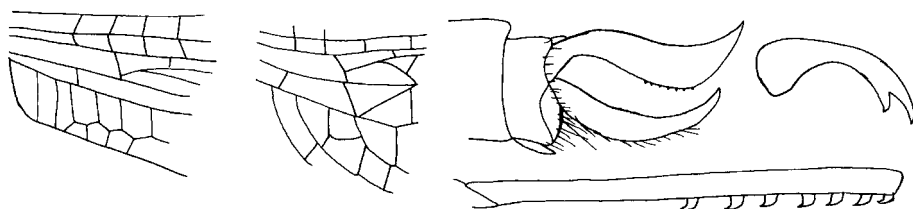


Fig. 3.2.372 *Macrothemis valida* male: the veins at the base of the fore wing (left) and those near the triangle of the hind wing (center), quadratic spines on the hind femur (lower right), fore-tarsal claw (upper right), and apex of the abdomen in lateral view (upper right center). Based on Navás (1916c).

10. Hind wing length of male: c. 30 mm. The specimen described was covered by a bluish gray pruinosity. The female has not been described. The dorsal surface of the inferior anal appendage is deeply concave (**Fig. 3.2.371**). Length of male abdomen with appendages: 27 to 28 mm.

.....*Macrothemis griseofrons* Calvert, 1909
 (Ceará, Pernambuco, Bahia). Syn: *Cendra cearana* Navás, 1916.

- Hind wing length of male: c. 33.5 mm. The coloration is mainly blackish with ferruginous markings on the head and bright green markings on the thorax and yellowish markings on the abdomen. There are about seven quadratic spines on the hind femur (**Fig. 3.2.372**). Total length of male: c. 44 mm. The female has not been described.

.....*Macrothemis valida* Navás, 1916 (Mato Grosso?). General opinion among specialists suggests that the correct name for this problematic species should be *Brechmorhoga valida* (Navás, 1916). However, until publication of a new description, it is maintained here.



Fig. 3.2.373 *Macrothemis inequiunguis* (left to right): tarsal claw, color pattern on the synthorax, male genitalia on the second abdominal segment in lateral view, and apex of the male abdomen. Based on Calvert (1898) and Costa (1990).

11. Length of abdomen: c. 18 mm. Hind wing length: c. 23 mm. Length of pterostigma: c. 1.0 mm. There is a row of about eight strongly curved spines with bases that are roughly quadrangular lining less than 2/3 of the length of the hind femur. The genital lobe on the second abdominal segment of the male is wider at its base than high (**Fig. 3.2.369**). The first two segments of the male abdomen are light brown; the third is black dorsally and light brown laterally and ventrally; the fourth through tenth segments are black with small light lateral spots. The anal appendages of the male are dark brown.

.....*Macrothemis newtoni* Costa, 1990 (Amazonas).

- Length of abdomen: 23.5 to 25 mm. Hind wing length: 24.5 to 28 mm. The hind wing has a posttriangular series of cells two cells wide. Total length of the female: c. 32 mm. Length of pterostigma: c. 2.0 mm. The wing membranes of the female are faintly yellowish, and the veins are sometimes bordered by brownish clouding. The pterostigma is black. There is a row of about ten strongly curved spines with bases that are roughly quadrangular lining the entire length of the hind femur. The genital lobe on the second abdominal segment of the male is higher than wide at its base. The subapical tooth is short and thick, appearing obliquely truncate (**Fig. 3.2.373**). The abdomen of the female is black with green stripes from the second through fifth abdominal segments, interrupted at the transverse carina on each segment. There are sometimes green spots on the sixth and seventh abdominal segments, as well.

.....*Macrothemis inequiunguis* Calvert, 1895 (Central America, Ecuador, Colombia, Venezuela). Syn: *Macrothemis vulgipes* Calvert, 1898.

12. The hind wing has two cubito-anal cross veins, and the hind femur of the male bears small triangular spines that are not curved parallel to the femur but point obliquely proximad. The apical segments of the male abdomen are not enlarged. The apical half of the superior anal appendage of the male curves dorsad and has a ventral tooth about 2/3 of the way from the base to apex. The hamule extends beyond the genital lobe and anterior lamina (**Fig. 3.2.374**). ...13

- The hind wing has one cubito-anal cross vein, or some of the spines on the hind femur of the male are curved so that their apex parallels the long axis of the femur, making them appear rectangular in outline (**Fig. 3.2.375**).14

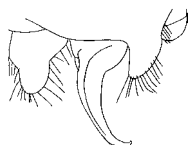


Fig. 3.2.374 Lateral view of the male genitalia on the second abdominal segment of *Macrothemis tenuis*. Based on Calvert (1898).

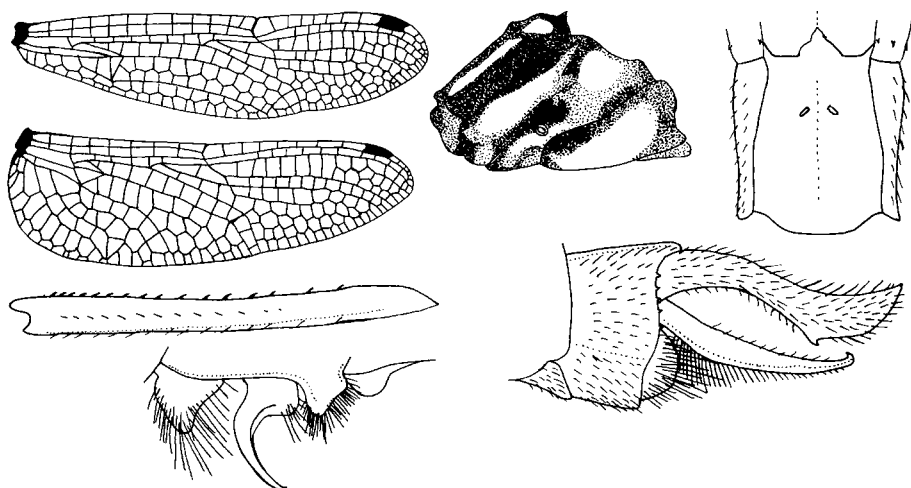


Fig. 3.2.375 *Macrothemis ludia*: fore and hind wing of a male (upper left); synthorax in lateral view showing the dark brown and pale green pattern (upper center); hind femur of a male (middle left); male genitalia on the second abdominal segment in lateral view (lower left); apex of the male abdomen in lateral view (lower right), and the vulvar lamina on the ninth abdominal segment of a female in ventral view (upper right). Based on Belle (1987a).

13. The dorsal part of the male frons is green with a transverse black spot. The upper end of the green antehumeral stripe just contacts the oblong green spot anterior to the antealar sinus. The anterior lamina of the male genitalia on the

second abdominal segment is divided to its base, and the hamule is almost sickle-shaped and extends farther ventrad than the genital lobe (**Fig. 3.2.374**). The entire posttriangular series of cells on the fore-wing is two cells wide. Total length of male: c. 40 mm. Length of male abdomen: c. 29.5 mm. Hind wing length of female: c. 28.5 mm. Length of pterostigma: c. 2.0 mm. The female has not been described.

.....*Macrothemis tenuis* Hagen, 1868
(Argentina, São Paulo).

- The dorsal part of the male frons is mainly metallic blue without a black spot. The upper end of the green antehumeral stripe is separated from the oblong green spot anterior to the antealar sinus (**Fig. 3.2.376**). The anterior lamina is divided only at its apex. In the posttriangular series of cells on the fore-wing, the pattern of two cell rows is interrupted near the middle by short sections one cell wide. Total length: 39 to 40 mm. Length of abdomen: 29 to 29.5 mm. Hind wing length of female: 28 to 30 mm. Length of pterostigma: c. 2.0 mm.

.....*Macrothemis marmorata* Hagen, 1868
(Argentina, São Paulo). Syn: *Macrothemis tenuis* Karsch, 1890.

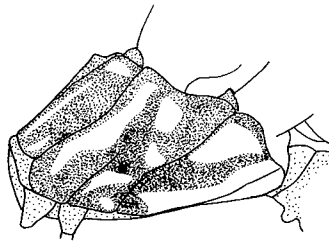


Fig. 3.2.376 Synthorax of a male *Macrothemis marmorata* in lateral view showing the color pattern. Based on Calvert (1898).

14. The hind wing has one cubito-anal cross vein, and none of the approximately 16 spines on the hind femur of the male are curved so that their apex parallels the long axis of the femur; they are all obliquely directed (**Fig. 3.2.375**). The abdomen, especially that of the male, is longer than the hind wing. Total length of male: c. 37 mm; female: c. 34.5 mm. Length of male abdomen with appendages: c. 28 mm; female: c. 25.5 mm. Hind wing length of male: c. 25 mm; female: c. 24.5 mm. The head is blackish dorsally and brown on the face. The thorax is dark brown with pale green markings. The abdomen is black with brownish yellow markings.

.....*Macrothemis ludia* Belle, 1987
(Venezuela).

- The hind wing has two cubito-anal cross veins, or, if it has one, then some of the spines on the hind femur of the male are curved parallel to the axis femur, or the hind wing is longer than the abdomen (**Fig. 3.2.377**).15

15. Both the male and the female abdomens are considerably shorter than the hind wing, with the abdomen of a male being about 23 mm long, and the hind wing, 27 mm. Corresponding lengths for a female are about 19 mm and 26 mm, respectively. The terminal segment of the male abdomen is only moderately expanded. The superior anal appendage of the male is evenly curved and bears a ventral tooth very near the truncate apex. The abdomen is black with two longitudinal orange stripes on either side of the narrow black stripe along the mid-dorsal carina and with upper incisions that are narrow and broad lower incisions (**Fig. 3.2.377**). The wings of the male are hyaline with a yellow-green tinge, while those of the female have a deep, sulfur-yellow tinge. The pterostigma is about 1.5 mm long.

.....*Macrothemis flavescens* (Kirby, 1897)
(Peru, Venezuela, Guyana, French Guiana, Mato Grosso). Syn: *Miathyria flavescens* Kirby, 1897.

- The abdomen of the male is slightly shorter than the hind wing or longer, and its apex is widened to form a dorsally flattened disc or scarcely widened at all (**Fig. 3.2.378**). If there is doubt, then the hind wing is 20 mm or shorter. The abdomens of females of some species are considerably shorter than the hind wing.16

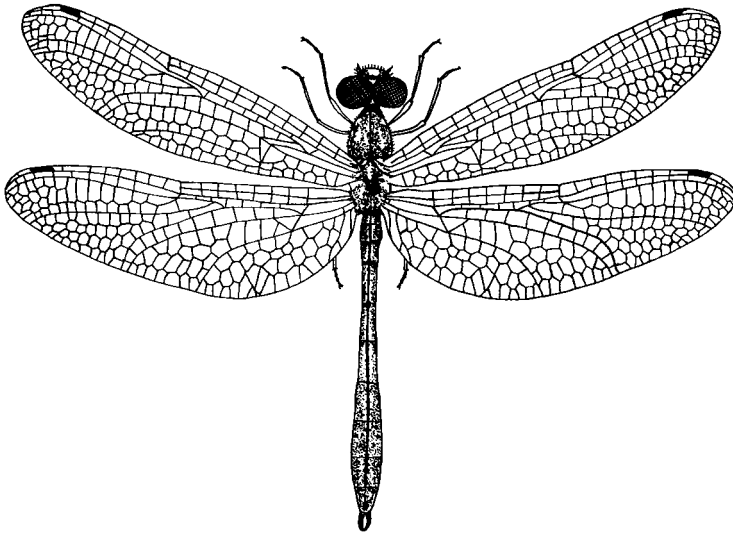


Fig. 3.2.377 Habitus of a male *Macrothemis flavescens*. Based on Kirby (1897).

16. The male abdomen is scarcely broadened at the seventh and eighth segments.17
- The abdomen of the male is strongly broadened at the seventh and eighth segments.26

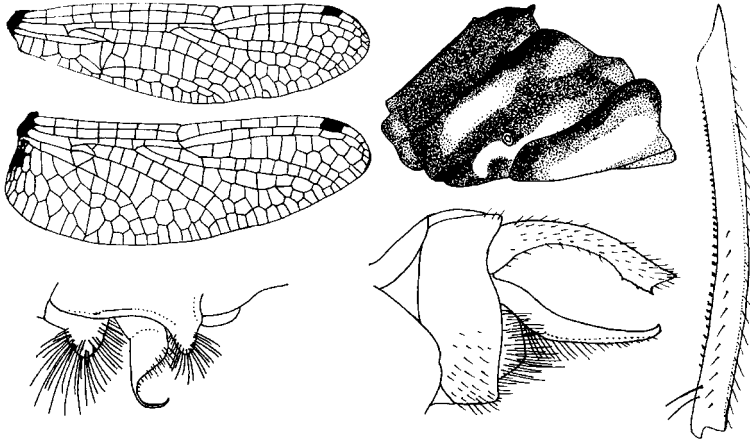


Fig. 3.2.378 *Macrothemis belliata*: fore and hind wing of a male (upper left); synthorax in lateral view showing the dark brown and pale green pattern (upper center); hind femur of a male (right); male genitalia on the second abdominal segment in lateral view (lower left); apex of the male abdomen in lateral view (lower center). Based on Belle (1987a).

17. The abdomen of the male is thin and cylindrical, exceeding the hind wing in length considerably. The abdomen of the male is about 34 mm long, while the hind wing is about 25 mm. The length of the pterostigma is about 1.5 mm. The hamule extends nearly straight ventral from the body until a subapical bend curves the very fine tip posteriad (**Fig. 3.2.379**). The coloration is black with three straight yellow stripes separated from one another by two black stripes.

.....*Macrothemis extensa* Ris, 1913
(Central America, Peru, Venezuela, French Guiana, Pará).

- The abdomen of males and females are shorter than the hind wings or only slightly longer, seldom, if ever, exceeding them by more than 2 mm.18



Fig. 3.2.379 *Macrothemis extensa* male: lateral views of the genitalia on the second abdominal segment (left) and apex of the abdomen (right). Based on Ris (1913a).

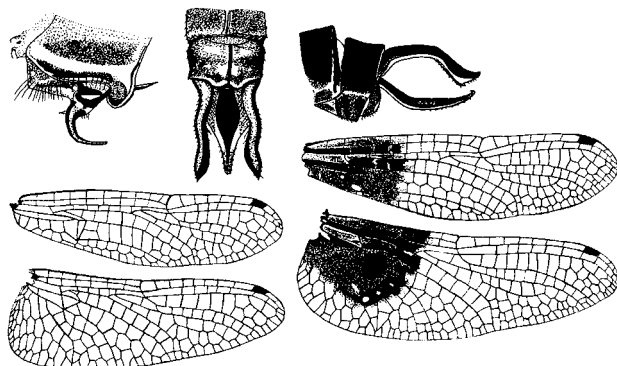


Fig. 3.2.280 *Macrothemis pumila* male (above, left to right): male genitalia on the second abdominal segment in lateral view and apex of the male abdomen in dorsal and lateral view, and the fore and hind wing of a male (lower left) and a female (lower right). Based on Ris (1913a).

18. Known males and females have one posttrigonal row of cells in the hind wing, at least for the first three or four cells (**Fig. 3.2.378**).19
 - Females have more than one posttrigonal row of cells in the hind wing, starting from the triangle or one cell beyond. The abdomen is at least 27 mm long, and the hind wing is at least 26 mm long.21

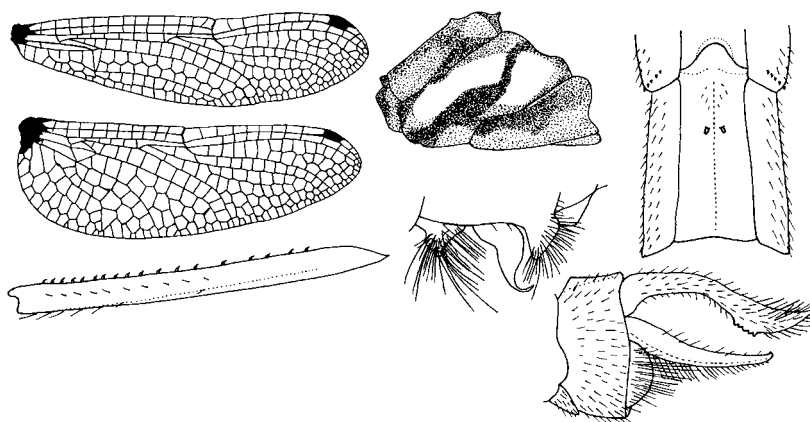


Fig. 3.2.281 *Macrothemis proterva*: fore and hind wing of a male (upper left); synthorax in lateral view showing the black, brown, and bright yellow pattern (upper center); hind femur of a male (lower left); male genitalia on the second abdominal segment in lateral view (center); apex of the male abdomen in lateral view (lower right), and the vulvar lamina on the ninth abdominal segment of a female in ventral view (upper right). Based on Belle (1987a).

19. There is one row of cells in the trigonal space of the fore-wing (**Fig. 3.2.378**). Pale antehumeral stripes are completely absent. The hind femur bears a closely set row of 35 to 40 small quadratic spines with their apices directed distad. The subtriangle in the fore-wing is not crossed. Total length of male: c. 25 mm. Length of male abdomen: c. 17 mm long. Hind wing length of male: c. 19 mm. The female has not been described. The color is predominantly black, except for the synthorax, which is dark brown with pale green markings.

.....*Macrothemis belliata* Belle, 1987
(Venezuela, Surinam).

- There are two or more rows of cells in the trigonal space of the fore-wing (**Fig. 3.2.280**).20

20. The length of the cylindrical male abdomen is about 19 to 21.5 mm, and that of the female is 15 to 17.5 mm. The hind wing of both sexes is 19 to 21.5 mm long. The antehumeral stripes are pale. Sometimes, the subtriangle in the fore-wing is crossed. The hind femur bears a closely set row of about 25 triangular spines with their apices directed distad. The general coloration is blackish with small yellow lateral markings on the anterior segments. The wings are hyaline with yellow to amber clouds at the bases and black pterostigmas. The superior anal appendages of the male are obviously sinuous in dorsal view (**Fig. 3.2.280**).

.....*Macrothemis pumila* Karsch, 1890
(Colombia, Trinidad, Peru, Venezuela, Guyana, French Guiana, Brazil). Syn: *Macrothemis pumila* var. *axillata* Navás, 1924.

- The abdomens of males and females are about 24 mm long. The hind wing of the male is about 24.5 mm, and that of the female is about 25.5 mm. The costal margin of the pterostigma in the fore-wing is about 1.6 mm. The hind femur of the male bears a row of about 18 to 20 quadratic spines. The head and dorsal surface of the thorax are blackish and brown, while the lateral surface of the synthorax is brown with black stripes and strongly contrasting greenish white markings. The legs are brown, and each wings is hyaline with black veins, a brown pterostigma, and yellowing on a small area at the base. The abdomen is dark brown on the entire first two segment and on the ventral side of the first nine and nearly black on the rest. The superior anal appendage of the male bears a row of about five denticles (**Fig. 3.2.281**).

.....*Macrothemis proterva* Belle, 1987
(Venezuela).

21. The spines on its hind femur of the male are roughly rectangular with apices bent parallel to the longitudinal axis of the femur. The abdomen is yellowish or pale olive brown with blackened sutures and carinae; it is cylindrical and as long or longer than the hind wings with apical segments not notably wider than the others. The superior anal appendages are truncate or rounded at the apices (**Fig. 3.2.382**). Length of male abdomen: c. 33 mm; female: c. 29 mm. Hind wing length of male: c. 33 mm; female: c. 34 mm. Length of pterostigma: c. 2 mm.

.....*Macrothemis inacuta* Calvert, 1898
(Mexico, Central America, Venezuela, Brazil). Syn: probably *Macrothemis rochai* Navás, 1918.

- The male hind femur bears small triangular spines that are not curved parallel to the femur but point obliquely proximad. The abdomen is predominantly blackish brown marked with green or yellow.22

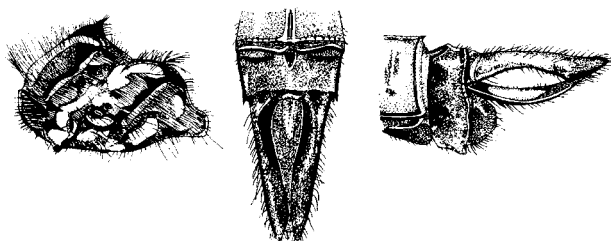


Fig. 3.2.382 *Macrothemis inacuta* male (left to right): lateral view of the synthorax and the apex of the abdomen in dorsal and lateral view. Based on Needham *et al.* (2000).

22. The frons and vertex of the male do not have a prominent metallic blue marking.23

- The frons and vertex have a prominent metallic blue patch.24

23. The vertex is light green with a blackish base and dark median line. The frons is bordered with dark gray. The antehumeral stripe is wedge-shaped with the dorsal side broadest; it is continuous with a stripe across the wing sinus. There is a small comma-shaped yellow mark in the lateral surface of the seventh abdominal segment. Length of male abdomen: c. 28 mm. Hind wing length of male: c. 23 mm.

.....*Macrothemis capitata* Calvert, 1909
(Rio de Janeiro).

- The vertex is dark brown with a metallic luster. A narrow antehumeral stripe does not quite reach the broader stripe across the wing sinus to form a T. There is no lateral comma-shaped mark but instead a prominent dorsal pair of spots covering almost the entire width and $\frac{3}{4}$ of the length of the seventh abdominal segment. The hamule resembles a slightly curved sickle (**Fig. 3.2.383**). Length of male abdomen: c. 30 mm. Hind wing length of male: c. 26 mm.

.....*Macrothemis hahneli* Ris, 1913
(Colombia, Peru, Ecuador, Venezuela).

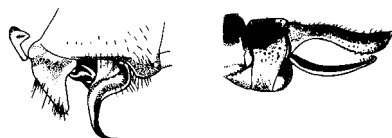


Fig. 3.2.383 *Macrothemis hahneli* male: lateral views of the genitalia on the second abdominal segment (left) and apex of the abdomen (right). Based on Ris (1913a).

24. The thorax of the female is mainly pale brown with extensive pale green markings (**Fig. 3.2.384**). That of the male is brown with cream lateral stripes. The wings have a strong yellow tinge, at least in the basal half. Total length of female: c. 37 mm. Length of female abdomen: c. 27.5 mm. Hind wing length of female: 26 to 27 mm. The frons is brilliant bluish black in the male and dull black in the female. The abdomen is mainly black with small yellow dorsolateral markings on the anterior and posterior surfaces of the third to seventh abdominal segments.

.....*Macrothemis musiva* Calvert, 1898
(Central America, Colombia, Ecuador, Peru, Venezuela, French Guiana, Bolivia, Paraguay, Argentina, Rio de Janeiro, São Paulo, Rio Grande do Sul, Mato Grosso do Sul, Mato Grosso). Syn: *Macrothemis uniseries* Calvert, 1909.
- The thorax is mainly blackish or dark brown with some lighter markings, which may be extensive laterally (**Fig. 3.2.385**).25

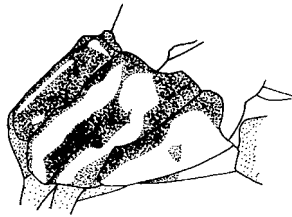


Fig. 3.2.384 Synthorax of a female *Macrothemis musiva* in lateral view showing the pale brown and pale green color pattern. Based on Calvert (1898).

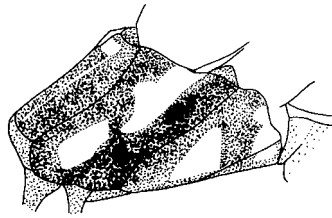


Fig. 3.2.385 Synthorax of a male *Macrothemis pleurosticta* in lateral view showing the color pattern. Based on Calvert (1898).

25. The thorax is mainly dark brown laterally with two pale spots arranged obliquely one above the other on the mesepimeron and metepimeron (**Fig. 3.2.385**). The labrum is pale blue or yellow. There is no pale green spot posterior to the hind coxa. The superior anal appendages are clearly longer than the inferior appendages and acutely pointed at the apex; there is a small ventral tooth about 2/3 of the way from the base to the apex. Total length: c. 39.5 mm.

Length of male abdomen: c. 28 mm. Hind wing length of male: c. 28.5 mm. Pterostigma length: c. 2 mm.

.....*Macrothemis pleurosticta* (Burmeister, 1839) (Brazil). Syn: *Libellula pleurosticta* Burmeister, 1839.

- The thorax is blackish with a yellow anterior lobe and yellow dorsolateral markings, including wedge-shaped rays, and extensive yellow areas on the lateral surface. There are yellow lateral stripes only on the third abdominal segments. The remaining segments are mainly blackish. The apices of the superior anal appendages are obviously divergent (**Fig. 3.2.386**). Length of abdomen: 27 to 29 mm. Length of hind wing: 29 to 30 mm.

.....*Macrothemis guarauno* Rácenis, 1957 (Venezuela, French Guiana).

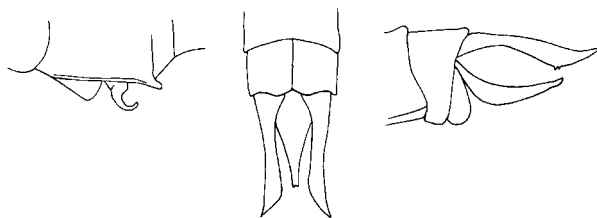


Fig. 3.2.386 *Macrothemis guarauno* male (left to right): lateral view of the genitalia on the second abdominal segment and the apex of the abdomen in dorsal and lateral view. Based on Rácenis (1957).

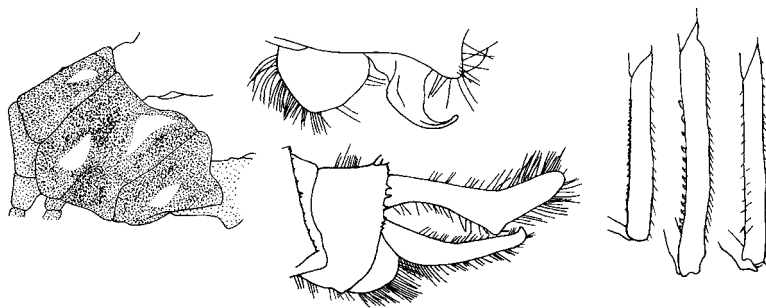


Fig. 3.2.387 *Macrothemis imitans* male: synthorax in lateral view showing the color pattern (left), genitalia on the second abdominal segment in lateral view (upper center), apex of the abdomen in lateral view (lower center), and the middle femur of a male and hind femur of a male and a female (right, left to right). Based on Calvert (1898).

26. Laterally, the thorax of the male is largely pale green or yellow with dark lines or narrow stripes. The seventh and eighth abdominal segments of the male are greatly widened.27

- The thorax is mainly dark brown with three to five pale spots or short stripes on the lateral surface formed by an anastomosis of the dark pattern (**Fig. 3.2.387**).32
- 27. The spines on its hind femur are roughly rectangular with apices bent parallel to the longitudinal axis of the femur.28
- The spines on the distal half of the male hind femur are small, triangular, and close set, although they tend to curve apicad somewhat; on the proximal third of this femur, there are five or six long, straight spines pointed obliquely distad and a thick line of long, black, hair-like setae. There are numerous long spines arranged closely together on the middle face of the hind tibia, longer spines on the lateral margin, and a dense group of long, black, hair-like setae on the distal half. The first three abdominal segments are greenish yellow dorsally with a black median stripe and darker lateral markings. The remaining segments are mainly dark. Teeth on the ventral sides of the male superior anal appendages are usually evident (**Fig. 3.2.388**).31

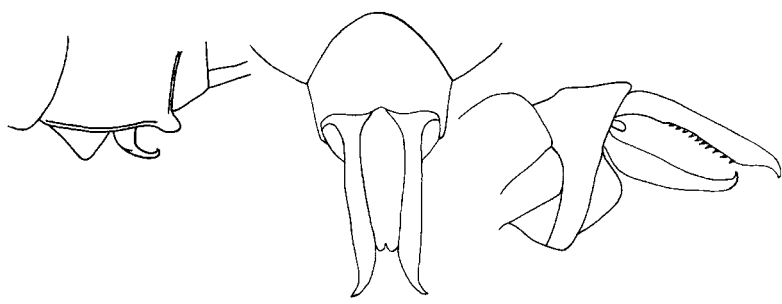


Fig. 3.2.388 *Macrothemis nobilis* male (left to right): lateral view of the genitalia on the second abdominal segment and the apex of the abdomen in dorsal and lateral view. Based on Rácenis (1957).

28. Mature male and female specimens are covered by a bluish pruinescence and have two rows of discoidal cells in the hind wing, where there are four to five rows of cells between vein A_3 and the margin of the wing.
.....*Macrothemis polyneura* Ris, 1913
(Peru, Guyana, Surinam, Argentina, São Paulo).
- No males and no known females are covered with a bluish pruinescence.29
29. The hamule is relatively straight but has a curve only just proximal to the finely pointed apex. In the apical third of the superior anal appendage of the male, there is a vestige of a blunt ventral angle, and about four low, blunt teeth are present on the ventral surface. The distal and of the superior appendage is, at most, only slightly curved dorsad. There are two rows of discoidal cells in the hind wing.
.....*Macrothemis cynthia* Ris, 1913
(Venezuela, Brazil).

- The hamule has a strong, sickle-like curve. There is no ventral angle evident on the superior anal appendage of the male (**Fig. 3.2.389**).30

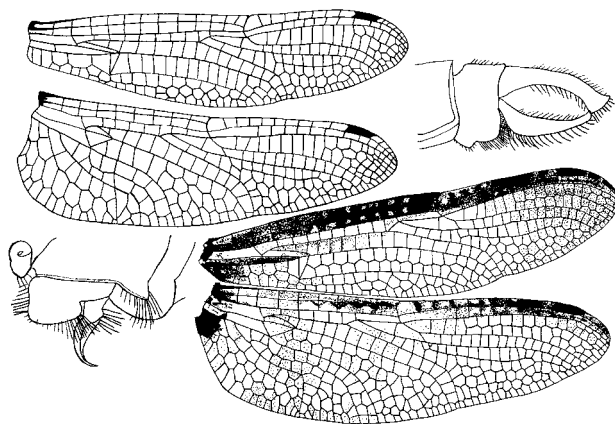


Fig. 3.2.389 *Macrothemis delia*: uniformly obfuscated fore and hind wing of a male (upper left), male genitalia on the second abdominal segment in lateral view (lower left); apex of the male abdomen in lateral view (upper right); fore and hind wing of a female (lower right). Based on Ris (1913a).

30. The superior anal appendages of the male are as long as the ninth and tenth segments combined, curve ventrad in the basal half, then curve dorsad and remain straight in the distal half to their narrow, acutely pointed apices. There is a row of four or five denticles between $\frac{1}{4}$ and $\frac{1}{2}$ of the way from the base to the apex on the ventral surface of each superior anal appendage, and the largest of these is the one farthest from the base. The inferior anal appendage has a V-shaped emargination at the apex (**Fig. 3.2.390**). In the male, there is one row of discoidal cells in the hind wing, but the female possesses two such rows. The fore-wing of the female is usually brown from the nodus to the apex of the wing. The abdomen is dark brown with a narrow yellow stripe on each side from the second through the eighth segment. Laterally, the thorax of the male is largely pale green or yellow with brown stripes along the first and second lateral sutures. That on the second suture branches to the metasternum. The antehumeral stripes are wedge-shaped and longer in the female than in the male. The abdomen is dark brown with a narrow yellow stripe on each side from the second through the eighth segment. Total length: 27 to 35 mm. Abdomen length: 23 to 24.5 mm. Hind wing length: 27 to 31 mm.

.....*Macrothemis hemichlora* (Burmeister, 1839)
(Central America, Trinidad, Colombia, Ecuador, Peru, Venezuela, Surinam, French Guiana, Argentina, Mato Grosso, São Paulo). Syn: *Libellula hemichlora* Burmeister, 1839; *Macrothemis cydippe* Calvert, 1898.

- The superior anal appendages of the male curve evenly dorsoventrally and end in a blunt, slightly thickened apex. The inferior anal appendage is almost as long as the superior appendages. The wings of the male have uniformly clouded membranes, while those of the female usually have a pattern of light and dark markings, including darkened costal and subcostal spaces (**Fig. 3.2.389**).

.....*Macrothemis delia* Ris, 1913
(Central America, Venezuela, Surinam).

31. There are two cylindrical processes at the bases of the superior appendices of the male (**Fig. 3.2.388**). Length of abdomen: 29 mm. Length of hind wing: 33 mm. The female is undescribed.

.....*Macrothemis nobilis* Rácenis, 1957
(Venezuela, French Guiana, Amazonas).

- There is no trace of cylindrical processes at the bases of the superior anal appendages (**Fig. 3.2.391**). Length of abdomen: 29 to 29.5 mm. Length of hind wing: 33 to 35 mm.

.....*Macrothemis declivata* Calvert, 1909
(Venezuela, Bolivia, Paraguay, Argentina, Rio de Janeiro, São Paulo).

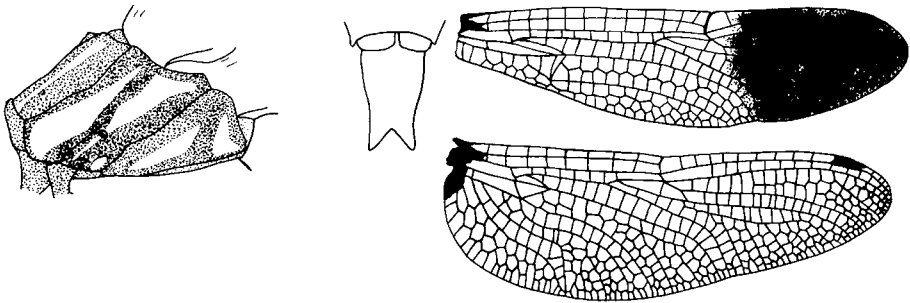


Fig. 3.2.390 *Macrothemis hemichlora* (left to right): synthorax of a female in lateral view showing its brown and pale green or yellow color pattern, inferior anal appendage of a male in ventral view, and fore and hind wing of a female. Based on Calvert (1898) and Ris (1913a).

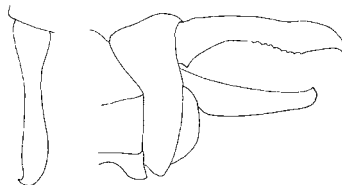


Fig. 3.2.391 *Macrothemis declivata* male: one superior anal appendage in dorsal view (left) and the apex of the abdomen in lateral view. Based on Calvert (1909b).

32. The thorax is largely dark chocolate brown with four prominent stripes, one on the ventral part of the mesepimeron, another on the dorsal part of the mesepisternum, and two, separated by a narrow dark line, on the posterior part of the metepimeron. The wings are completely hyaline or uniformly pale yellowish, except for the pterostigma. The abdomen of the male is about 27 mm long, and it is brownish black with somewhat lighter reddish stripes on some of the segments. The superior anal appendages of the male converge at midlength and are directed posteriad at their apices (**Fig. 3.2.392**). Length of abdomen: 27 mm. Length of hind wing: 29 mm. The female remains undescribed.

.....*Macrothemis rupicola* Rácenis, 1957
(Venezuela, French Guiana).

- The thorax is dark brown without four complete stripes and only pale spots on the lateral surface (**Fig. 3.2.393**).33

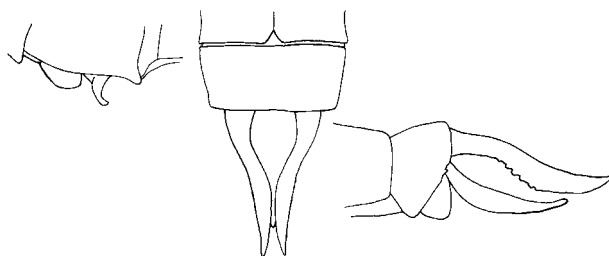


Fig. 3.2.392 *Macrothemis rupicola* male (left to right): lateral view of the genitalia on the second abdominal segment and the apex of the abdomen in dorsal and lateral view. Based on Rácenis (1957).

33. On the ventral surface of the superior anal appendage of the male, there is a pronounced triangular tooth at about its midlength; in dorsal view, these appendages are not obviously divergent at their bases, and they end in a somewhat blunt apex (**Fig. 3.2.387**). There is no obvious whitish blue pruinescence on the dorsal surfaces of the sixth through ninth abdominal segments. The spines on the hind femur are relatively small, and the tibiae are black. The lateral surface of the thorax is dark brown with three pale spots, two obliquely arranged on the mesepimeron and the third on the metepimeron. There is only an antehumeral spot and not a stripe anterior to the antealar sinus. Total length: c. 35 mm. Abdomen length: c. 24 mm. Hind wing length: c. 28.5 mm.

.....*Macrothemis imitans* Karsch, 1890
(Central America, Trinidad, Venezuela, Guyana, Bolivia, Paraguay, Uruguay, Argentina, Santa Catarina, São Paulo, Mato Grosso). Two subspecies have been described: *Macrothemis imitans imitans* Karsch, 1890 and *Macrothemis imitans leucozona* Ris, 1913.

- On the ventral surface of the superior anal appendage of the male, there is no pronounced tooth, but there is a row of five or six small, evenly-sized denticles running from $\frac{1}{4}$ to $\frac{1}{2}$ the length from the base to the apex, which is acutely pointed. The dorsal surfaces of the seventh and eighth abdominal segments of mature individuals are at least partially whitish-blue pruinose.34
 34. The tibiae are yellow or brown. The whitish blue pruinosity covers the dorsal surfaces of the greatly expanded sixth through ninth abdominal segments. In dorsal view, the superior anal appendages appear only moderately divergent at their bases. The lateral surface of the thorax is dark brown with four pale spots, two on the mesepimeron and two arranged obliquely on the metepimeron. The antehumeral stripe is wedge-shaped and almost reaches the anterior border of the mesothorax (**Fig. 3.2.393**).

.....*Macrothemis pseudimitans* Calvert, 1898
 (Mexico, Central America, Trinidad, Colombia, Ecuador, Venezuela, Espirito Santo, Rio de Janeiro, Mato Grosso).

- The tibiae are black. The whitish blue pruinosity covers only the dorsal surface of the seventh and part of the eighth abdominal segment, which are moderately enlarged. In dorsal view, the superior anal appendages appear strongly divergent at their bases. There are two rather long, thick spines directed dorsad at the apex of the inferior anal appendage of the male.

.....*Macrothemis mortoni* Ris, 1913
 (Ecuador, Peru, Venezuela, Bolivia).

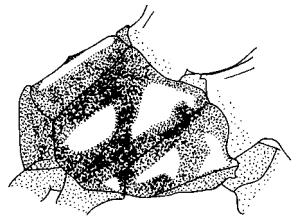


Fig. 3.2.393 Synthorax of a male *Macrothemis pseudimitans* in lateral view, showing the color pattern. Based on Calvert (1898).

Key to the species of known *Macrothemis* larvae in South America

Information was provided by Ramírez and Novelo-Gutiérrez (1999).

1. There is a dorsal protuberance on the second abdominal segment, and those on the seventh through ninth segments are prominent and spine-like. The labium has seven palpal setae (**Fig. 3.2.130**). The larva reaches a maximum length of 13 mm.

.....*Macrothemis inequiunguis* Calvert, 1895
 (Central America, Ecuador, Colombia, Venezuela). Syn: *Macrothemis vulgipes* Calvert, 1898. A Central American species, *Macrothemis aurimaculata* (Donnelly,

1984), also has a dorsal protuberance on the second abdominal segment, but the protuberances on the seventh through ninth segments are vestigial.

- There is no mid-dorsal protuberance on the second abdominal segment (**Fig. 3.2.394**).2

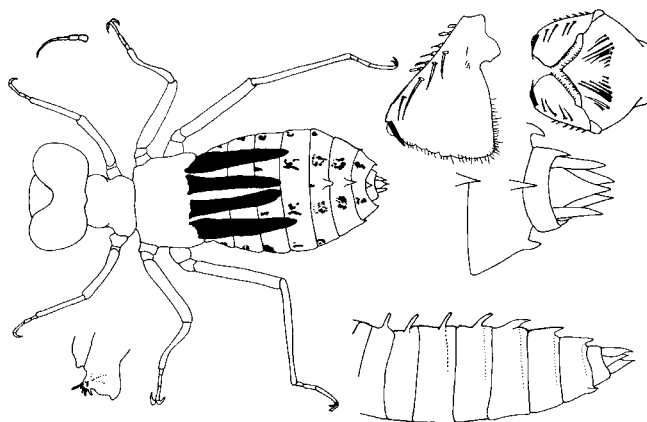


Fig. 3.2.394 *Macrothemis musiva* larva: habitus (middle left), antenna (upper left), the anterolateral corner of the median lobe of the prothorax in dorsal view (lower left), labium in dorsal view (upper right), labial palp in dorsal view (upper middle right), abdomen in lateral view (lower right), and the apex of the abdomen in dorsal view. Based on Santos (1970b).

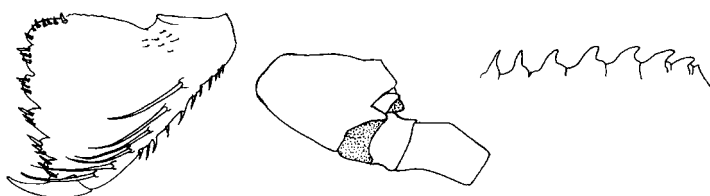


Fig. 3.2.395 *Macrothemis inacuta* larva: labial palp (left), hind coxa and trochanter showing the digitiform metacoxal process (center), and dorsal profile of the third through tenth abdominal segments (right). Based on Needham *et al.* (2000).

2. On the labium, there are four or five palpal setae and nine crenulations on each palp (**Fig. 3.2.394**).

.....*Macrothemis musiva* Calvert, 1898
(Central America, Colombia, Ecuador, Peru, Venezuela, French Guiana, Bolivia, Paraguay, Argentina, Rio de Janeiro, São Paulo, Rio Grande do Sul, Mato Grosso do Sul, Mato Grosso). Syn: *Macrothemis uniseries* Calvert, 1909.

- On the labium, there are six palpal setae and seven crenulations on each palp (**Fig. 3.2.395**).

3. On the labial palp, the movable hook is relatively thin with a thickness at mid-length not more than twice as thick as the adjacent palpal seta. The process on the hind coxa is vestigial. The dorsal hooks on the third through sixth abdominal segments are similar, and all hooks are acutely pointed (**Fig. 3.2.396**).

.....*Macrothemis pseudimitans* Calvert, 1898
(Central America, Trinidad, Colombia, Ecuador, Venezuela, Espirito Santo, Rio de Janeiro, Mato Grosso).

- On the labial palp, the movable hook at its midlength is at least three times as thick as the adjacent palpal seta. The process on the hind coxa is well developed and digitiform. The dorsal hook on the third abdominal segment is taller and thinner than those on the fourth through sixth segments, and all hooks are blunt at the apices. The dorsal protuberances on the eighth and ninth abdominal segments are similar to that on the seventh (**Fig. 3.2.395**).

.....*Macrothemis inacuta* Calvert, 1898
(Central America, Venezuela, Brazil). Syn: probably *Macrothemis rochai* Navás, 1918.

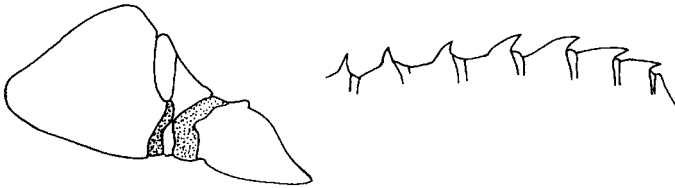


Fig. 3.2.396 *Macrothemis pseudimitans* larva: hind coxa and trochanter showing the vestigial metacoxal process (left) and the dorsal profile of the third through tenth abdominal segments (right). Based on Needham *et al.* (2000).

Key to the species of adult *Pantala* in South America

Information for the key was provided by Pastor (1968).

1. There is no dark marking at the anal angle of the hind wing, although there might be some yellowing (**Fig. 3.2.98**). Total length: c. 48 mm. Length of abdomen: c. 31 mm. Hind wing length: c. 42 mm. A brightly colored species with an attractive pattern. Male chromosome number: $2n = 25$, $n = 13$ (Ferreira *et al.*, 1979).

.....*Pantala flavescens* (Fabricius, 1798)
(Nearly cosmopolitan, but absent from Europe. The range in the Western Hemisphere includes North and Central America, West Indies, Colombia, Ecuador, Peru, Venezuela, Guyana, French Guiana, Surinam, Bolivia, Paraguay, Chile, Argentina, Uruguay, Brazil). Syn: *Libellula flavescens* Fabricius, 1798;

Libellula analis Burmeister, 1839; *Libellula terminalis* Burmeister, 1839; *Libellula viridula* Beauvois, 1805.

- There is a round blackish marking at the anal angle of the hind wing. Total length: c. 49 mm. Length of abdomen: c. 32 mm. Hind wing length: c. 42 mm. A brightly colored species with an attractive pattern.

.....*Pantala hymenaea* (Say, 1839)
(Nearly cosmopolitan with a range in the Americas from Alaska to southern Chile, including most of North and Central America, West Indies, Colombia, Ecuador, Peru, Venezuela, Chile, Argentina, Brazil). Syn: *Libellula hymenaea* Say, 1839; *Tramea huanacina* Förster, 1909.

Key to the species of *Pantala* larvae in South America

Information for the key was provided by Lamb (1929), Smith and Pritchard (1963), and Walker and Corbet (1975). The species in this genus are among the few dragonflies that have a nearly cosmopolitan distribution.

1. The lateral spine on the ninth abdominal segment is more than three times as long as its width at the base. In lateral view, the dorsal surface of the epiproct does not appear curved (**Fig. 3.2.114**). The crenulations on the distal margin of the lateral lobe of the labium are more than half as long as the moveable hook, and each lobe has 12 to 14 lateral setae. The mentum bears about 15 setae. The color pattern on the body is inconspicuous. The larvae may be encountered in temporary water bodies, which can be colonized because the larval development is so rapid (van Damme and Dumont, 1999).

.....*Pantala flavescens* (Fabricius, 1798)
(Nearly cosmopolitan, including North and Central America, West Indies, Colombia, Ecuador, Peru, Venezuela, Guyana, French Guiana, Surinam, Bolivia, Paraguay, Chile, Argentina, Uruguay, Brazil). Syn: *Libellula flavescens* Fabricius, 1798; *Libellula analis* Burmeister, 1839; *Libellula terminalis* Burmeister, 1839; *Libellula viridula* Beauvois, 1805.

- The lateral spine on the ninth abdominal segment is less than three times as long as its width at the base. In lateral view, the dorsal surface of the epiproct appears curved. The lateral margins of the abdominal segments and the caudal appendages bear setae (**Fig. 3.2.397**). The crenulations on the distal margin of the lateral lobe of the labium are half as long as the moveable hook, and each lobe has about 15 lateral setae. The mentum bears 17 or 18 setae. There is a conspicuous brown pattern on the body, including pairs of dark spots arranged on the dorsal surface of the abdominal segments.

.....*Pantala hymenaea* (Say, 1839)
(Nearly cosmopolitan, including North and Central America, West Indies, Colombia, Ecuador, Peru, Venezuela, Chile, Argentina, Brazil). Syn: *Libellula hymenaea* Say, 1839; *Tramea huanacina* Förster, 1909.

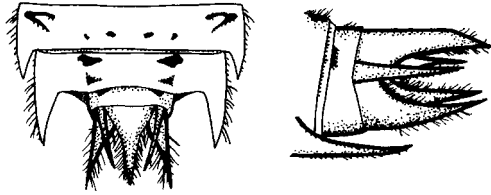


Fig. 3.2.397 *Pantala hymenaea* larva: apex of the abdomen with appendages in dorsal (left) and lateral view (right). Based on Needham *et al.* (2000).

Key to the species of adult *Tramea* in South America

Information for the key was provided by Pastor (1968), DeMarmels and Rácenis (1982), and Dunkle (2000).

1. The thorax is blackish red with two narrow, yellow, lateral stripes. Caution: the stripes can fade after long preservation.2
- There are no yellow stripes on the thorax, and none have faded due to long preservation.5

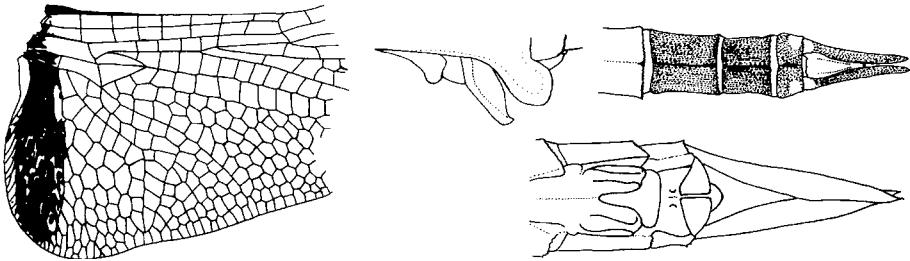


Fig. 3.2.398 *Tramea cophysa* (left to right): basal part of the hind wing of a male, genitalia on the second abdominal segment of a male in lateral view, the apices of the male abdomen in dorsal view (above), and the female abdomen in ventral view showing the vulvar lamella (below). Based on DeMarmels and Rácenis (1982).

2. The wing veins are reddish, and there is usually no trace of a dark marking at the base of the fore-wing. There is a dark basal marking on the hind wing that reaches no farther than vein Cu_1 (**Fig. 3.2.398**). The frons of the male is metallic violet as far as its anterior margin, and that of the female is red with only a band

of metallic coloration. Total length: c. 48 mm. Length of abdomen: c. 31 mm. Hind wing length: c. 42 mm.

.....*Tramea cophysa* Hagen, 1867
(Trinidad, Galapagos Islands, Ecuador, Peru, Venezuela, Guyana, Bolivia, Paraguay, Argentina, Uruguay, Rio de Janeiro, São Paulo, Mato Grosso do Sul, Mato Grosso). Syn: *Trapezostigma cophysa* (Selys, 1857); *Tramea darwini* Kirby, 1889.

- At the base of the fore-wing, there is an ochraceous marking, which is occasionally absent. There is a reddish or golden brown marking at the base of the hind wing that reaches beyond vein Cu_1 (**Fig. 3.2.399**).3

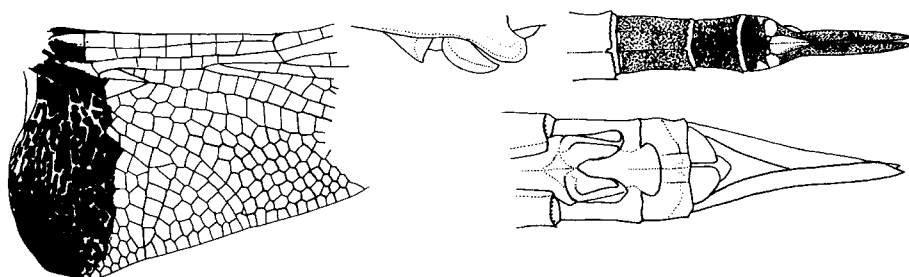


Fig. 3.2.399 *Tramea rustica* (left to right): basal part of the hind wing of a male, genitalia on the second abdominal segment of a male in lateral view, and the apices of the male abdomen in dorsal view (above) and the female abdomen in ventral view showing the vulvar lamella (below). Based on DeMarmels and Rácenis (1982).

3. The superior anal appendage of the male is much longer than the combined length of the eighth and ninth abdominal segments, and that of the female are about equal to the combined length of those segments (**Fig. 3.2.399**). The dorsal surface of the eighth abdominal segment is entirely black or black with small, poorly defined reddish markings. The basal marking on the hind wing reaches or enters the triangle, has a serrate distal border, and is not surrounded by a yellowish region. The frons of the male is completely metallic violet to its borders.

.....*Tramea rustica* DeMarmels and Rácenis, 1982
(Panama, Colombia, Venezuela, French Guiana, Surinam, Bolivia, Paraguay, Argentina, Mato Grosso, Rondônia).

- A superior anal appendage of either a male or female is shorter than the combined length of the eighth and ninth abdominal segments (**Fig. 3.2.400**). The basal marking on the hind wing is surrounded by a yellowish area, at least near the triangle, and does not have a serrate distal border. The metallic violet color

on the frons of the male is limited to the posterior part, while the anterior section of the frons becomes orange or yellow.4
 4. The eighth abdominal segment is completely black. Length of male abdomen: 25 to 26 mm; female: 24 to 28 mm. Hind wing length of male: 33 to 37 mm; female: 33 to 39 mm. In the hind wing, there are usually two cross veins between the sectors of the arculus anterior to the triangle (**Fig. 3.2.400**). There is only a narrow posterior band of metallic violet coloration on the frons of the male, but this color is more extensive in the female. The vulvar lamina occupies $3/5$ to $3/4$ of the length of the ninth abdominal segment, and it has a broad excision.

.....*Tramea minuta* DeMarmels and Rácinis, 1982
 (Venezuela, Amazonas, Mato Grosso).

- The eighth abdominal segment usually has a pair of red triangular or semi-circular anterodorsal markings. Length of male abdomen: 27 to 29 mm; female: 28 to 31 mm. Hind wing length of male: 39 to 42 mm; female: 40 to 43 mm. In the hind wing, there is usually one cross vein between the sectors of the arculus anterior to the triangle (**Fig. 3.2.401**). The metallic violet coloration on the frons of the male is broad on the posterior part, but it becomes purplish, orange, or yellow toward the anterior margin. The metallic violet band of the female is narrower. The length of the vulvar lamina varies from $4/5$ to the full length of the ninth abdominal segment, and it has a deep, narrow excision.

.....*Tramea calverti* Muttkowski, 1910
 (North and Central America, West Indies, Trinidad, Colombia, Ecuador including Galápagos Islands, Peru, Venezuela, Guyana, French Guiana, Surinam, Bolivia, Argentina, Rondônia, Amazonas, Bahía, Pará, São Paulo, Rio de Janeiro, Santa Catarina, Rio Grande do Sul).

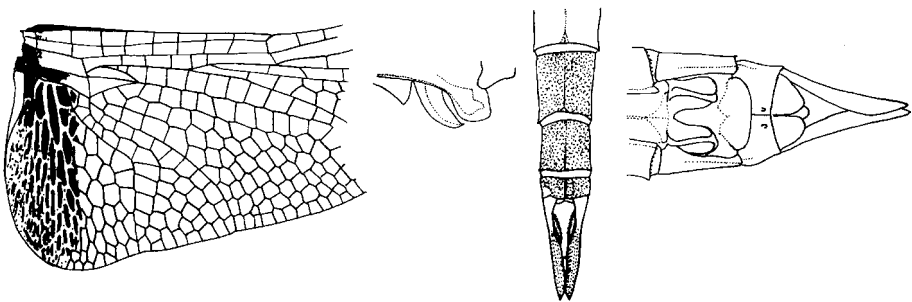


Fig. 3.2.400 *Tramea minuta* (left to right): basal part of the hind wing of a male, genitalia on the second abdominal segment of a male in lateral view, apex of the male abdomen in dorsal view, and apex of the female abdomen in ventral view showing the vulvar lamella. Based on DeMarmels and Rácinis (1982).

5. The dark marking at the anal angle of the hind wing extends as far as or beyond the triangle (**Fig. 3.2.104**).6
 - The dark marking at the anal angle of the hind wing does not reach the triangle (**Fig. 3.2.402**).7

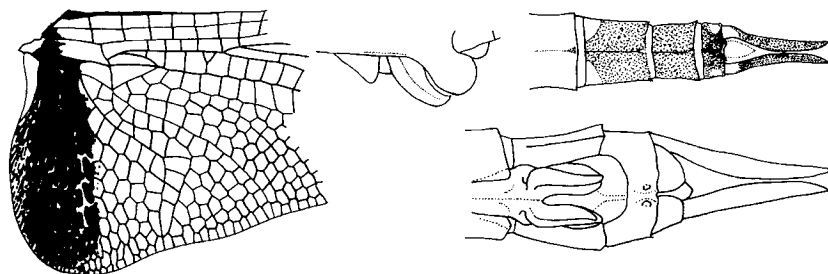


Fig. 3.2.401 *Tramea calverti* (left to right): basal part of the hind wing of a male, genitalia on the second abdominal segment of a male in lateral view, and the apices of the male abdomen in dorsal view (above) and the female abdomen in ventral view showing the vulvar lamella (below). Based on DeMarmels and Rácenis (1982).

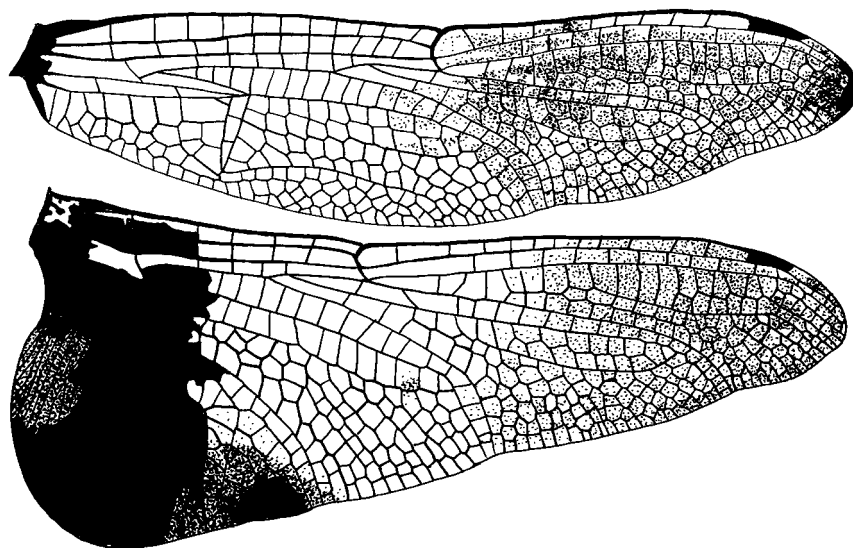


Fig. 3.2.402 Fore and hind wing of *Tramea onusta*. Based on Needham (1903).

6. The frons of both the male and the female is reddish. The wing membrane is usually heavily shaded (**Fig. 3.2.402**). Some males in North America have been found with the basal part of the frons violet, but the rest of it is reddish. Total length: 45 to 48 mm. Length of abdomen: 30 to 34 mm. Hind wing length: 38 to

40 mm. The abdomen of the male is pale red with small black dorsal markings on the apical segments.

.....*Tramea onusta* Hagen, 1861
(North and Central America, West Indies, Venezuela).

- The frons of the male is uniformly metallic violet; that of the female is partially violet. The abdomen of the male is bright red with extensive black dorsal markings on the apical segments. The vulvar lamina on the ninth abdominal segment of the female is divided into two elongate lobes by a V-shaped excision (**Fig. 3.2.403**).

.....*Tramea carolina* (Linnaeus, 1763)
(North and Central America, recently discovered in Rio de Janeiro, perhaps introduced).

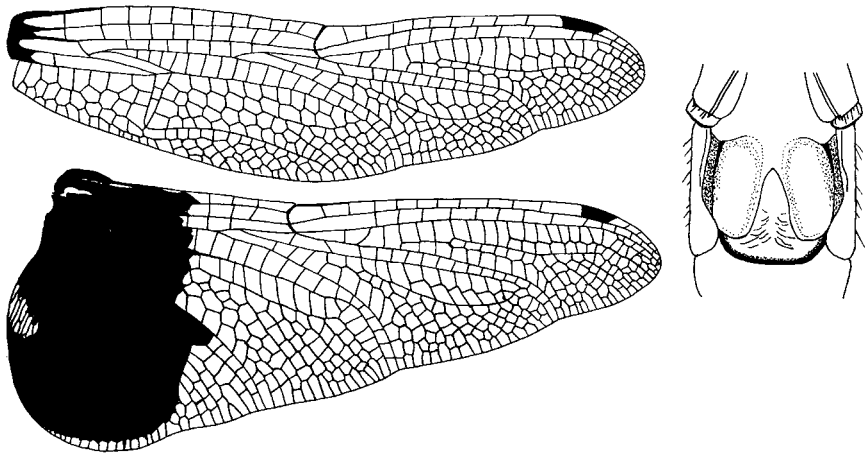


Fig. 3.2.403 *Tramea carolina*: fore and hind wing (left) and a ventral view of the vulvar lamina on the ninth abdominal segment of the female. Based on Needham and Westfall (1955).

7. The frons of both the male and female is red (**Fig. 3.2.104**). Total length: c. 42 mm. Length of abdomen: c. 32 mm. Hind wing length: 39 to 41 mm. The face is red, and the frons is brown in immature males, red in mature males, and yellow in females. The male is predominantly brown, becoming bright red when the male matures. There is a black middorsal stripe on the eighth through tenth abdominal segments. Females of the two species in this couplet cannot always be distinguished.

.....*Tramea abdominalis* (Rambur, 1842)
(North and Central America, West Indies, Trinidad, introduced to Hawaii, Colombia, Ecuador, Peru, Venezuela, Paraguay, Argentina, Rio de Janeiro, São Paulo, Mato Grosso do Sul). Syn: *Libellula abdominalis* Rambur, 1842; *Libellula basalis* (nec Stephens, 1835) Burmeister, 1839.

- The frons of the male is metallic violet, and that of the female has a narrow black basal band (**Fig. 3.2.404**). The veins in the basal half of the wing are reddish. Mature males become entirely black. Immature males and females are predominantly reddish with violet markings on the head. Total length: c. 42 mm. Length of abdomen: c. 29 mm. Hind wing length: c. 37 mm. Male chromosome number: $2n = 25$, $n = 13$ (Ferreira *et al.*, 1979). Females of the two species in this couplet cannot always be distinguished.

.....*Tramea binotata* (Rambur, 1842)
(Central America, West Indies, Trinidad, Colombia, Ecuador, Peru, Venezuela, French Guiana, Surinam, Paraguay, Argentina, Rio de Janeiro, São Paulo, Mato Grosso). Syn: *Libellula binotata* Rambur, 1842; *Tramea brasiliiana* Brauer, 1867; *Tramea longicauda* Brauer, 1867; *Tramea subbinotata* Brauer, 1867; *Tramea paulina* Förster, 1910; *Tramea walkeri* Whitehouse, 1943.

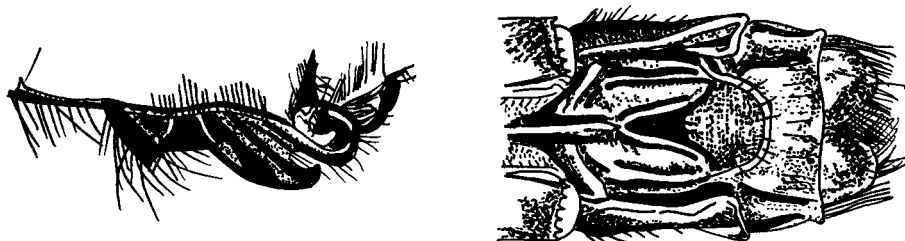


Fig. 3.2.404 *Tramea binotata*: male genitalia on the second abdominal segment in lateral view (left) and the apex of the female abdomen in ventral view (right). Based on Needham *et al.* (2000).

Key to the species of *Tramea* larvae in South America

Information for the key was provided by Irineu de Souza *et al.* (1999a) and Dunkle (2000).

1. The epiproct is about 2/3 as long as the paraproct (**Fig. 3.2.405**). Larvae usually inhabit small standing water bodies.

.....*Tramea abdominalis* (Rambur, 1842)
(North and Central America, West Indies, Trinidad, introduced to Hawaii, Colombia, Ecuador, Peru, Venezuela, Paraguay, Argentina, Rio de Janeiro, São Paulo, Mato Grosso do Sul). Syn: *Libellula abdominalis* Rambur, 1842; *Libellula basalis* (nec Stephens, 1835) Burmeister, 1839.

- The epiproct is 5/6 to 6/7 as long as the paraproct (**Fig. 3.2.406**).2
- 2. Each cercus is less than 2/3 as long as a paraproct (**Fig. 3.2.406**).3
- Each cercus is 5/7 as long as a paraproct or longer (**Fig. 3.2.116**).4

3. Each cercus is about $\frac{3}{4}$ the length of the epiproct and $\frac{3}{5}$ the length of a paraproct (**Fig. 3.2.406**).

.....*Tramea cophysa* Hagen, 1867
(Trinidad, Galapagos Islands, Ecuador, Peru, Venezuela, Guyana, Bolivia, Paraguay, Argentina, Uruguay, Rio de Janeiro, São Paulo, Mato Grosso do Sul, Mato Grosso). Syn: *Trapezostigma cophysa* (Selys, 1857); *Tramea darwini* Kirby, 1889.

- Each cercus is about $\frac{4}{5}$ the length of the epiproct and $\frac{2}{3}$ the length of a paraproct (**Fig. 3.2.407**). Inhabits clear lentic and slowly flowing lotic water.

.....*Tramea carolina* (Linnaeus, 1763)
(North and Central America, recently discovered in Rio de Janeiro, perhaps introduced).

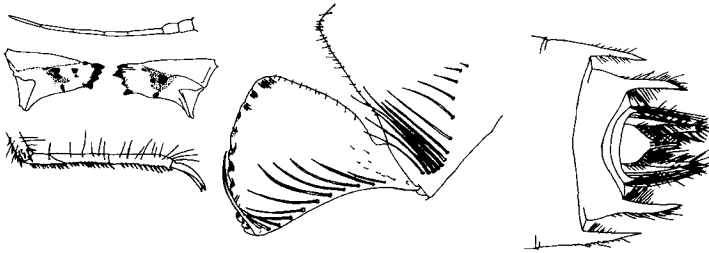


Fig. 3.2.405 *Tramea abdominalis* larva: antenna (upper left), inner surfaces of mandibles (middle left), hind tarsal segments (lower left), left side of the mentum and the left labial palp (center), and the apex of the abdomen in dorsal view. Based on Geijskes (1935).

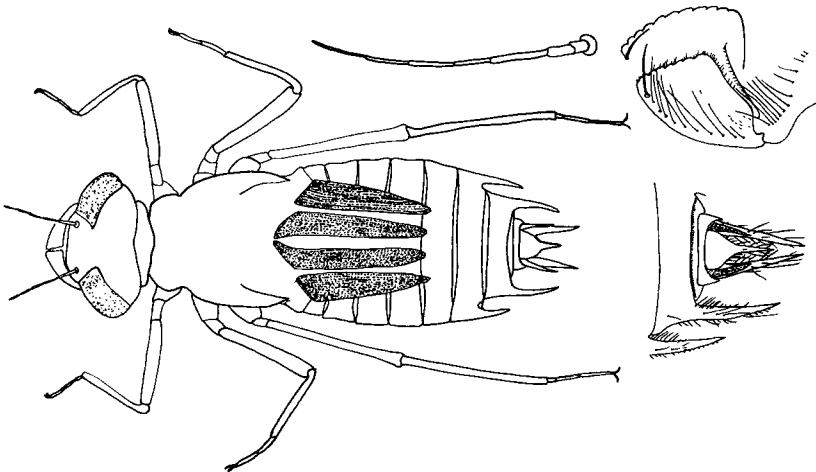


Fig. 3.2.406 *Tramea cophysa* larva: habitus (left), enlarged antenna (upper center), left labial lobe with its serrated margin enlarged above it (upper right), and the apex of the abdomen in dorsal view with only the left lateral spines shown (lower right). Based on Santos (1968c).

4. Each cercus is about $\frac{2}{3}$ the length of the epiproct and $\frac{4}{5}$ the length of a paraproct. The larva inhabits clear lentic and slowly flowing lotic water.

.....*Tramea onusta* Hagen, 1861
(North and Central America, West Indies, Venezuela).

- Each cercus is about $\frac{6}{7}$ the length of the epiproct and $\frac{5}{7}$ the length of a paraproct (**Fig. 3.2.116**). Inhabits standing water bodies, including temporary ones, and it may occur in brackish water.

.....*Tramea calverti* Muttkowski, 1910
(North and Central America, West Indies, Trinidad, Colombia, Ecuador including Galápagos Islands, Peru, Venezuela, Guyana, French Guiana, Surinam, Bolivia, Argentina, São Paulo).

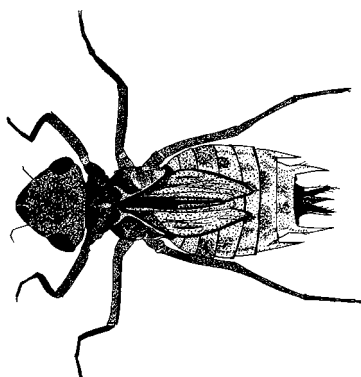


Fig. 3.2.407 A *Tramea carolina* larva. Based on Needham *et al.* (2000).

Key to the species of adult *Tauriphila* in South America

Information for the key was provided by Ris (1913b), Pastor (1968) and Needham *et al.* (2000). Descriptions of the females are not sufficient to permit identification of all species.

1. In dorsal view, the superior anal appendages of the male appear strongly divergent at their bases and convergent at their apices; in lateral view, the basal $\frac{2}{3}$ of their dorsal surface is strongly convex, and the apical $\frac{1}{3}$ is straight.2

- In dorsal view, the superior anal appendages of the male are parallel or divergent (**Fig. 3.2.408**).3

2. The adult male is red with a red face and a patch on the vertex that is metallic violet on a reddish base. The darkened base of the wing usually extends to the anal angle and continues along the margins of the wing veins (**Fig. 3.2.409**). In anterior view, the hamules are relatively narrow with parallel lateral margins except near the apex. There are denticles lining about $\frac{2}{3}$ of the ventral surface

of the superior anal appendage. Length of abdomen: c. 30 mm. Hind wing length: 35 to 39 mm.

.....*Tauriphila argo* (Hagen, 1869)
(Central America, West Indies, Trinidad, Ecuador, Peru, Venezuela, Guyana, French Guiana, Bolivia, Paraguay, Argentina, Rio de Janeiro, São Paulo, Mato Grosso do Sul). Syn: *Tramea argo* Hagen, 1869; probably *Tauriphila nycteris* Karsch, 1890.

- Fully mature males are very dark and pruinose, appearing grayish blue and bright blue. The face is blackish brown with a shiny metallic blue marking on the vertex. The darkening at the base of the wing is small with a yellowish margin, and it does not extend beyond the end of the membranule. The margins of the adjacent veins are not darkly shaded. The wings are usually tinged with yellow. In anterior view, the hamules appear broad with the lateral margins evenly curved. The ninth segment of the female abdomen bears long setae bordering the vulvar lamina (**Fig. 3.2.410**).

.....*Tauriphila xiphea* Ris, 1913
(Paraguay, Argentina, Rio de Janeiro).

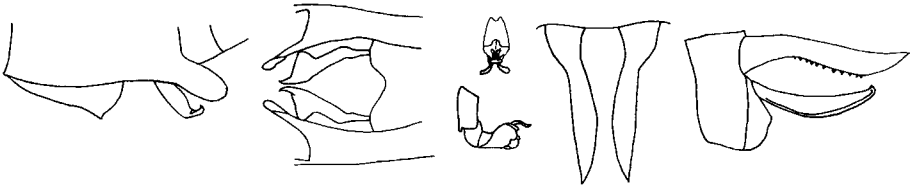


Fig. 3.2.408 *Tauriphila australis* male (left to right): genitalia on the second abdominal segment in lateral and ventral view, the penis in ventral (above) and lateral view (below), superior anal appendages in dorsal view, and apex of the abdomen in lateral view. Based on Santos (1946c).

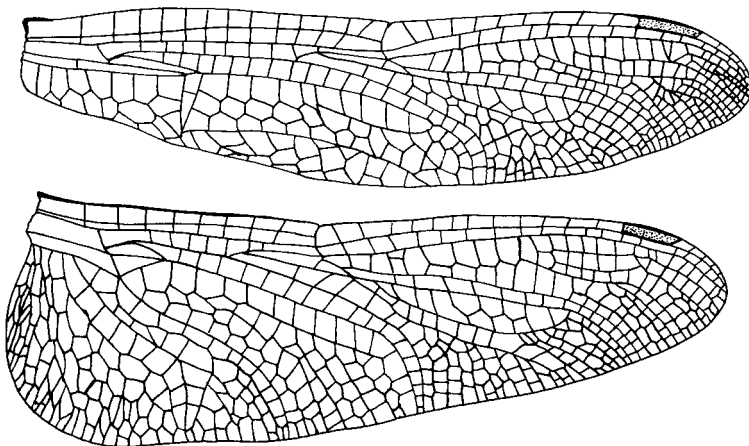


Fig. 3.2.409 Fore and hind wing of a male *Tauriphila argo*.

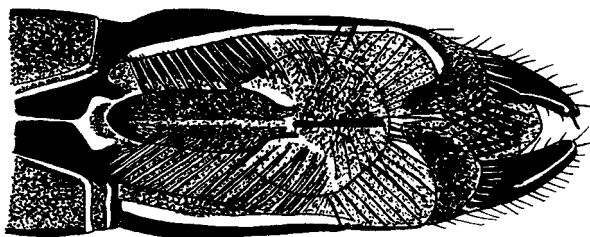


Fig. 3.2.410 Apex of the female abdomen of *Tauriphila xiphea*. Based on Ris (1913).

3. In dorsal view, the superior anal appendages of the male are convergent in the basal half and strongly divergent toward the apex, making their outer margins strongly concave (**Fig. 3.2.105**). Male chromosome number: $2n = 25$, $n = 13$ (Mola and Agopian, 1985).

.....*Tauriphila risi* Martin, 1896
(Bolivia, Paraguay, Argentina, Uruguay, Brazil).

- In dorsal view, the superior anal appendages of the male nearly parallel; in lateral view, the dorsal surface is almost straight. There are denticles lining about 4/5 of the ventral surface of the superior anal appendage (**Fig. 3.2.408**). Black bands cover no more than the posterior tenth of the third through seventh abdominal segments, and these bands are sometimes completely absent. Total length: c. 43 mm. Length of abdomen: c. 29 mm. Hind wing length: c. 36 mm.

.....*Tauriphila australis* (Hagen, 1867)
(Central America, West Indies, Colombia, Trinidad, Ecuador, Peru, Venezuela, French Guiana, Surinam, Bolivia, Paraguay, Mato Grosso). Syn: *Tramea australis* Hagen, 1867; probably *Tramea iphigenia* Hagen, 1867.

Key to the species of *Tauriphila* larvae in South America

Information for the key was provided by Costa and Assis (1994), Rodrigues Capitulo (1996), and Westfall (1998).

1. There is a middorsal hook on each of the abdominal segments from the third through the eighth, and these increase progressively in length. Some specimens may also have a tiny spine on the ninth segment, as well. The lateral spine of the eighth segment is about $\frac{3}{4}$ the length of that segment, and that on the ninth is about twice as long as the segment's middorsal length (**Fig. 3.2.411**).

.....*Tauriphila australis* (Hagen, 1867)
(Central America, West Indies, Colombia, Trinidad, Ecuador, Peru, Venezuela, French Guiana, Surinam, Bolivia, Paraguay, Brazil). Syn: *Tramea australis* Hagen, 1867; probably *Tramea iphigenia* Hagen, 1867.

- There is no middorsal hook on the third abdominal segment, although there may be an acute elevation that does not curve posteriad; those on the fourth through eighth increase in size progressively (**Fig. 3.2.412**).

2. The dorsal spine on the seventh abdominal segment reaches that posterior margin of the eighth segment (**Fig. 3.2.128**). The abdomen is flattened ventrally. Total length of final instar: c. 18 to 19 mm.

.....*Tauriphila risi* Martin, 1896
(Bolivia, Paraguay, Argentina, Uruguay, Brazil).

- The dorsal spine on the seventh abdominal segment reaches only about half way to the apex of the eighth segment. The abdomen is rounded ventrally. The lateral spine on the eighth is straight and at least half as long as the middorsal length of the segment, and that on the ninth is slightly curved dorsad and twice as long as the segment (**Fig. 3.2.412**). Total length of final instar without the antenna: c. 19 to 20 mm. Antenna length: c. 3.5 mm.

.....*Tauriphila argo* (Hagen, 1869)
(Central America, West Indies, Trinidad, Ecuador, Peru, Venezuela, Guyana, French Guiana, Bolivia, Paraguay, Argentina, Rio de Janeiro, São Paulo, Mato Grosso do Sul). Syn: *Tramea argo* Hagen, 1869; probably *Tauriphila nycteris* Karsch, 1890.

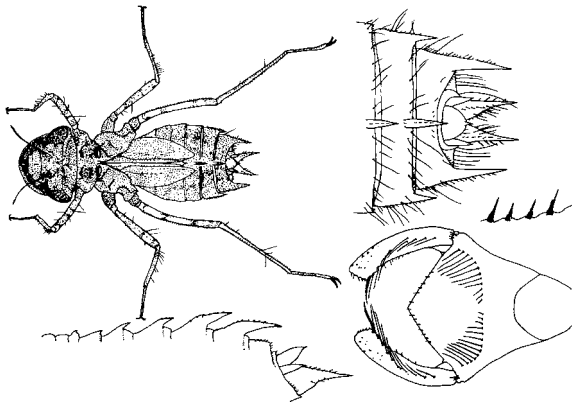


Fig. 3.2.411 *Tauriphila australis* larva: habitus (upper left), profile of the dorsal surface of the abdomen (lower left), apex of the abdomen in dorsal view (upper right), labium (lower right), and outline of the internal edge of the labial palp (middle right). Based on Westfall (1998).

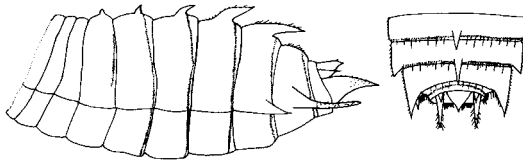


Fig. 3.2.412 *Tauriphila argo* larva: abdomen in lateral view (left) and its apex in dorsal view (right). Based on Needham *et al.* (2000).

Key to the species of adult male *Elasmotheremis* in South America

Information for the key was provided by Santos (1945f, 1949c) and DeMarmels (1989a).

1. The apical part of the genital lobe on the second abdominal segment of the male is approximately triangular, and the apex forms a rounded acute angle (**Fig. 3.2.107**).2
- The genital lobe on the second abdominal segment of the male is broadly rounded or approximately quadrangular and set obliquely to the body axis (**Fig. 3.2.413**).3

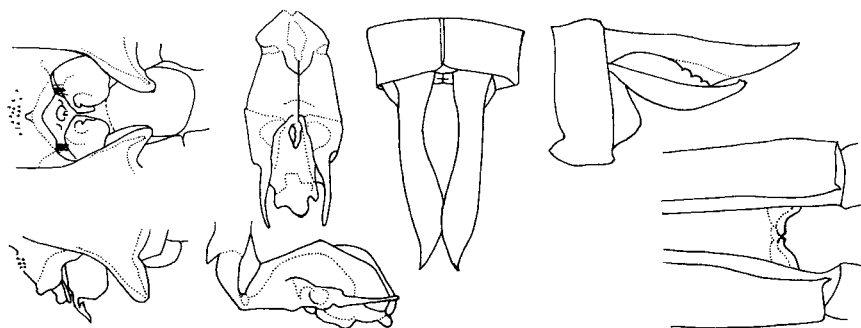


Fig. 3.2.413 *Elasmotheremis kiautai* (left to right): male genitalia on the second abdominal segment in ventral (above) and lateral view (below), penis in ventral (above) and lateral view (below), apex of the male abdomen in dorsal and lateral view (above), and the vulvar lamina on the ninth abdominal segment of the female in ventral view. Based on DeMarmels (1989a).

2. The hamule extends only slightly below the anterior lamina, and its inner branch is spatulate. The anterior lamina itself is produced and elongate at the apex (**Fig. 3.2.107**). The predominant color of the insect is dark metallic green, and it has a bluish pruinosity.

.....*Elasmotheremis williamsoni* (Ris, 1919)
(Guyana, French Guiana, Surinam) Syn: *Dythemis williamsoni* Ris, 1919.

- At the apex, the hamule is produced into a narrow digitiform process extending far below the anterior lamina, which is not notably produced at the apex (**Fig. 3.2.413**). The predominant color of the insect is reddish brown and not obviously pruinose. Total length of males and females: c. 42 mm. Abdomen length of males and females without appendages: 26.5 mm. Hind wing length: c. 36 to 37 mm.

.....*Elasmotheremis kiautai* (DeMarmels, 1989)
(Venezuela) Syn: *Dythemis kiautai* DeMarmels, 1989.

3. The thorax has two broad yellow stripes. Length of male abdomen: c. 34 mm. Hind wing length of male: c. 33 mm. Length of pterostigma: c. 5 mm.

.....*Elasmothemis alcebiadesi* (Santos, 1945)
(São Paulo) Syn: *Dythemis alcebiadesi* Santos, 1945.

- The thorax is uniformly brown or dark brown.4

4. The most apical tooth on the superior anal appendage of the male is located in the apical 1/6, and the teeth are distributed over the entire basal 5/6 of the appendage. The inferior anal appendage is about 5/7 as long as the superior appendage.

.....*Elasmothemis constricta* (Calvert, 1898)
(Argentina, Paraguay, São Paulo). Syn: *Dythemis constricta* Calvert, 1898;
Macrothemis willincki Fraser, 1947.

- The most apical tooth on the superior anal appendage of the male is located proximal to the apical 1/6 of the appendage, and the teeth are distributed over no more than 3/4 of the length of the appendage.5

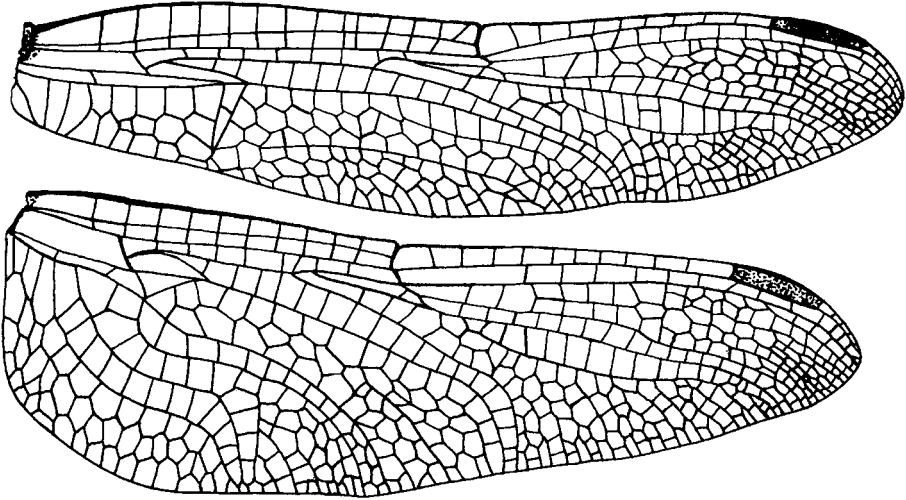


Fig. 3.2.414 Fore and hind wing of *Elasmothemis cannaerioides*.

5. The most apical tooth on the superior anal appendage of the male is located about 2/3 of the way from the base to the apex, and the teeth are distributed approximately on the middle third of the appendage. The inferior anal appendage is about 4/5 as long as the superior appendage. The entire body is nearly uniform reddish brown in color, with the male having a somewhat brighter red dorsal surface of the abdomen and the female having blackish lines at the junctions of the abdominal segments. The tibiae and tarsi are blackish, and

the wings are hyaline with black veins and dark grayish pterostigmas (**Fig. 3.2.414**). Male chromosome number: $2n = 21$, $n = 11$ (Ferreira *et al.*, 1979).

.....*Elasmothermis cannaerioides* (Calvert, 1906)
(Central America, Trinidad, Colombia, Ecuador, Peru, Venezuela, French Guiana, Argentina, Mato Grosso, São Paulo). Syn: *Dythemis cannaerioides* Calvert, 1906.

- The most apical tooth on the superior anal appendage of the male is located about 3/4 of the way from the base to the apex, and the teeth are distributed on the basal 3/4 of the appendage. The inferior anal appendage is about 3/4 as long as the superior appendage. Length of male abdomen: 29 to 31 mm. Hind wing length of male: 33 to 35 mm. The color is mainly ferruginous, but there are some blackish ventrolateral markings on the abdomen. The wings are hyaline with yellowish bases; the pterostigma is nearly black, and the membranule is grayish. The female has not been described.

.....*Elasmothermis schubarti* (Santos, 1945)
(São Paulo). Syn: *Dythemis schubarti* Santos, 1945.

Key to the known species of *Elasmothermis* larvae in South America

Information for the key was provided by Costa and Assis (1992).

1. The lateral spine on the ninth abdominal segment does not extend to the apex of the paraproct. The dorsal spine on the eight abdominal segment is obviously shorter than the spines on the segments anterior to it and does not reach the posterior end of the ninth segment (**Fig. 3.2.415**).

.....*Elasmothermis williamsoni* (Ris, 1919)
(Guyana, French Guiana, Surinam) Syn: *Dythemis williamsoni* Ris, 1919.

- The lateral spine on the ninth abdominal segment extends beyond the apex of the paraproct (**Fig. 3.2.416**).2

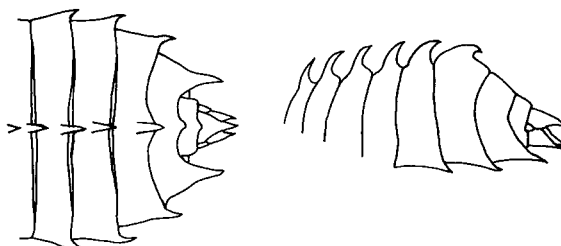


Fig. 3.2.415 *Elasmothermis williamsoni* larva: apical abdomen segments in dorsal (left) and lateral view (right). Based on Westfall (1988).

2. The lateral spine on the ninth abdominal segment is twice as long as the middorsal length of the ninth segment. The middorsal spines on the third

through seventh segments are hooked. There are 11 to 13 premental setae (**Fig. 3.2.133**).

.....*Elasmothermis constricta* (Calvert, 1898)
(Argentina, Paraguay, São Paulo) Syn: *Dythemis constricta* Calvert, 1898;
Macrothemis willincki Fraser, 1947.

- The lateral spine on the ninth abdominal segment is about as long as the middorsal length of the ninth segment. The middorsal spines on the fifth through seventh segments are hooked. There are 9 or 10 premental setae (**Fig. 3.2.416**).

.....*Elasmothermis cannaerioides* (Calvert, 1906)
(Central America, Trinidad, Colombia, Ecuador, Peru, Venezuela, French Guiana, Argentina, Mato Grosso, São Paulo). Syn: *Dythemis cannaerioides* Calvert, 1906.

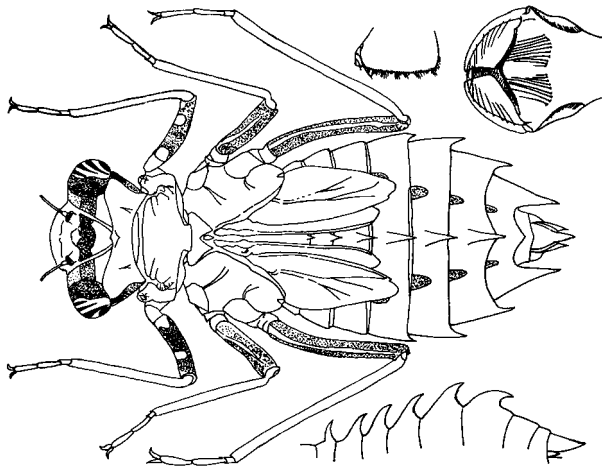


Fig. 3.2.416 *Elasmothermis cannaerioides* larva: habitus from exuvia (left), inner edge of the labial palp (upper right center) and entire labial palp (upper right), and the dorsal outline of the abdomen in lateral view (lower right). Based on Westfall (1988).

Key to the species of adult *Dythemis* in South America

Information for the key was provided by Ris (1918). DeMarmels (1989b) described a hybrid between the two known South American *Dythemis* species, which is somewhat darker than both parents, suggesting that these may be two races of only one species. Sufficient information to prepare a key to the larvae is not yet available.

1. The fore-head is yellow or yellowish red, sometimes with a somewhat coppery shine. The markings on the thorax are chocolate brown, sometimes with

a slight metallic shine, and light greenish yellow. The fourth through seventh abdominal tergites have yellowish lateral stripes that extend a distance more than half the length of the tergite. The wings are diffusely yellowish with a variable dark seam at the tips (**Fig. 3.2.108**).

.....*Dythemis sterilis* Hagen, 1861
(Mexico, Central America, West Indies, Venezuela, Colombia, French Guiana, Argentina, São Paulo).

- The fore-head is bluish green or metallic blue. The markings on the thorax are black with a green metallic sheen and light yellowish green or bright green. The fourth through seventh abdominal tergites have tiny greenish lateral spots that extend for a distance much less than half the length of the tergite, or nearly half on the seventh tergite. The wings are hyaline or slightly grayish with a variable dark seam at the tips and a small yellowish area at the base (**Fig. 3.2.417**). Male chromosome number: $2n = 25$, $n = 13$ (Ferreira *et al.*, 1979).

.....*Dythemis multipunctata* Kirby, 1894
(Venezuela, French Guiana, Argentina, Peru, Mato Grosso, Mato Grosso do Sul, São Paulo, Santa Catarina).

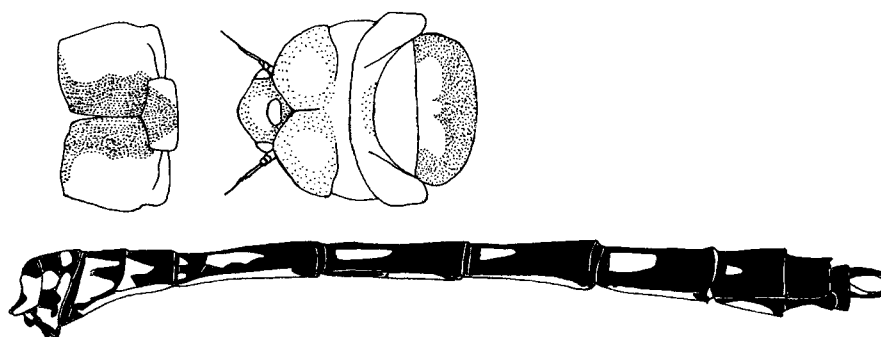


Fig. 3.2.417 *Dythemis multipunctata* male: labium and the part of the head between the compound eyes with the ventral parts to the right (above, left and right, respectively), and the color pattern of the abdomen in lateral view. Based on DeMarmels (1989b).

Austropetaliidae

Key to the genera of adults in South America

Information for the key was provided by Fraser (1933), Dunkle (1985), and Carle (1996).

1. The lateral ocelli and compound eyes are clearly separated. The transverse occiput bears a spine directed dorsad. The discoidal triangles contain three cells

in each wing. The subtriangle in the fore-wing consists of three cells, and that in the hind wing, consists of two (**Fig. 3.2.418**). The postclypeus is brown.

.....*Hypopetalia* MacLachlan, 1870

The only known species in this genus is *Hypopetalia pestilens* MacLachlan, 1870, from Chile.

- The lateral ocelli and compound eyes are almost touching. The occiput is not transverse and does not bear a spine directed dorsad. The discoidal triangles contain two cells in each wing. All subtriangles consist of only one cell. The Tenth segment of the female abdomen is narrow without any sign of dilation (**Fig. 3.2.419**). The clypeus is yellow.

.....*Phyllopetalia* Selys, 1857..p. 377

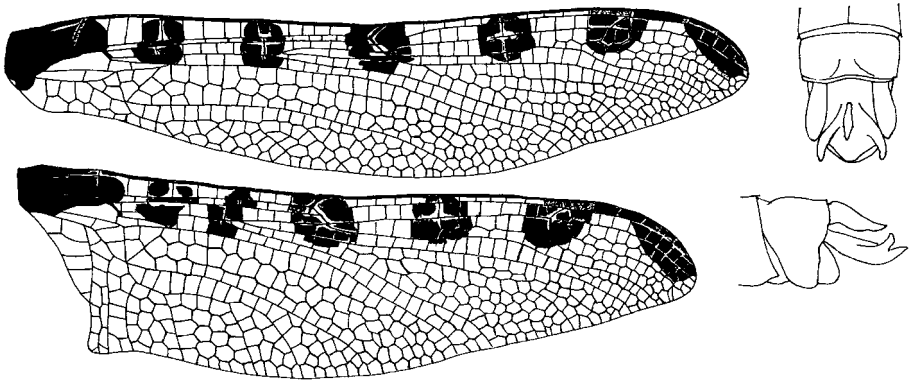


Fig. 3.2.418 *Hypopetalia pestilens* male: fore and hind wing (left) and the apex of the abdomen in dorsal (upper right) and lateral view (lower right). Based on Fraser (1933).

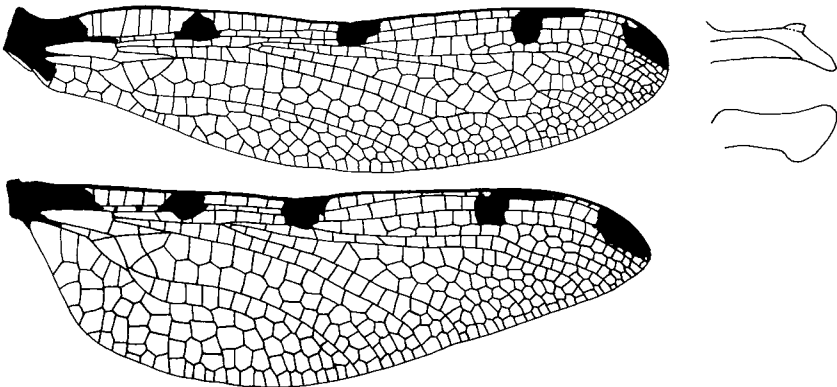


Fig. 3.2.419 *Phyllopetalia stictica*: fore and hind wing of a female (left) and the apex of the superior anal appendage in dorsolateral (upper right) and dorsomedial view (lower right). Based on Fraser (1933) and Dunkle (1985).

Key to the species of adult *Phyllopetalia* in South America

Information for the key was provided by Fraser (1933), Dunkle (1985), and Carle (1996). The key includes several dubious species, as noted, which were included in the keys provided by Carle (1996). Full descriptions are lacking, and no illustrations were provided. Some of these species have not been generally accepted, and probable synonymy is indicated where appropriate, pending further taxonomic work.

1. The heights of the antefrons and clypeus are subequal. The occiput has a transverse ridge bearing a sparse fringe of pale hair-like setae. The ventral margins of the lateral yellow stripes on the thorax are black. The hind wing has a well-developed membranule. The margins of the tergites on the seventh abdominal segment are extended to form wing-like structures, which are at least six times as long as their maximum width. The brown lines separating the stripes on the third through sixth abdominal segments are much narrower than the stripes themselves. Branches of the male inferior anal appendages extend much farther posteriad than the superior appendages (**Fig. 3.2.420**).2
- The height of the antefrons is greater than that of the clypeus. The occiput is globe-like or pyramidal and is not fringed with pale setae. The ventral margins of the lateral yellow stripes on the thorax are not black. The membranule is vestigial. The expanded, wing-like margins of the tergites on the seventh abdominal segment are no more than four times as long as their maximum width. The brown lines separating the stripes on the third through sixth abdominal segments are about as wide as the stripes themselves. Branches of the male inferior anal appendages extend about as far posteriad as the superior appendages (**Fig. 3.2.421**).4

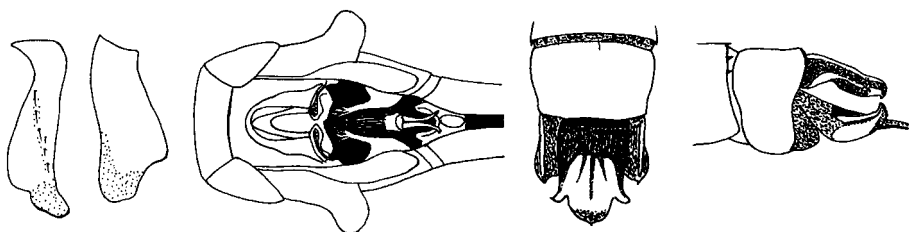


Fig. 3.2.420 *Phyllopetalia apicalis* male (left to right): superior anal appendage in dorsolateral and dorsomedial view, genitalia in the second abdominal segment in ventral view, and the apex of the abdomen in dorsal and lateral view. Based on Fraser (1933) and Dunkle (1985).

2. The narrow lateral flanges along the margins of the tergites on the seventh and eighth abdominal segments are similar. There is a large median tooth on the superior anal appendage of the male. Counting the reddish brown base of the wing and the opaque reddish brown marking at the apex, there are usually six opaque reddish brown spots near the anterior margin of each wing (**Fig. 3.2.15**). The inferior anal appendage is about twice as long as its width at the rami. Total length: 63 to 72 mm. Length of abdomen: 47 to 56 mm. Length of the hind wing of the male: 36 to 41 mm; female: 41 to 45 mm. The labrum is mainly yellow. The setae in the fringe on the occiput are coppery orange. The dorsal stripes on the mesanepisternum are parallel-sided. The third through seventh abdominal segments are mainly brownish yellow distal to the antecostal suture. Adults were observed flying from September through January.

.....*Phyllopetalia apollo* Selys, 1878
(Chile).

- The flanges along the lateral margins of the seventh abdominal tergite form narrow rims, while those on the eighth segment are broad and foliate. There is no large median tooth on the superior anal appendage of the male (**Fig. 3.2.420**). The labrum is mainly brown. The setae in the middle of the fringe on the occiput are pale yellow. The dorsal stripes on the mesanepisternum are widened near the middle. The third through seventh abdominal segments have yellow submedial spots distal to the antecostal suture.3

3. The antefrons is not as high as the postclypeus. The setae in the fringe on the occiput are pale yellow in the middle and black behind the compound eyes. Counting the darkened base of the wing and the opaque marking at the apex, there are usually five opaque spots near the anterior margin of each wing. Total length: 66 to 72 mm. Length of abdomen of male: 53 to 59 mm; female: 49 to 53 mm. Length of the hind wing of the male: 38 to 44 mm; female: 43 to 45 mm. The setae in the fringe on the occiput are pale yellow in the middle and black behind the compound eyes. Posterior to the antecostal sutures of males, there are yellow rectangles on the fourth and fifth abdominal segments, yellow triangles on the sixth and seventh segments, and complete yellow stripes on the eighth and ninth. The ninth abdominal segment of the male is longer than wide (**Fig. 3.2.420**). Adults were observed flying from September through January.

.....*Phyllopetalia apicalis* (Selys, 1857)
(Chile). Syn: *Phyllopetalia decorata* Selys, 1878. Carle (1996) recognized two subspecies: *Phyllopetalia apicalis apicalis* (Selys, 1857) with a yellow postclypeus and wing blotches plainly evident, and *Phyllopetalia apicalis decorata* (McLachlan in Selys, 1878) with a yellowish white postclypeus and vestigial wing blotches.

- The antefrons is higher than the postclypeus. The setae in the fringe on the occiput are black, except for a pale tuft in the middle. Total length: 71 to 84 mm. Length of abdomen of male: 61 to 66 mm; female: 54 to 59 mm. Length of the hind wing of the male: 44 to 47 mm; female: 44 to 48 mm. The setae in the fringe on the occiput are pale yellow in the middle and black behind the compound eyes. Posterior to the antecostal sutures of males, there are only

traces of yellow markings on the fourth through ninth abdominal segments. The ninth abdominal segment of the male is wider than long. Adults were observed flying from October through January.

.....*Phyllopetalia rex* (Carle, 1996)
(Chile). Syn: *Rheopetalia rex* Carle, 1996. This is not a generally accepted species and is likely to prove to be a synonym of *Phyllopetalia apicalis*.

4. The basal marking on the wing is uniform wine red. The occiput does not have a tripartite ridge or an anterodorsal spine. The lateral flanges on the seventh abdominal segment are widest proximal to the posterior carina on the tergite. There is no ventral keel-like spine on the superior anal appendage of the male. The antefrons is uniform black or brownish with yellow on the antefrontal carina. The dorsal stripes on the mesanepisternum and abdomen are bluish green.5

- The basal marking on the wing is brown, and it may be vestigial. The occiput has a tripartite ridge and an anterodorsal spine. The lateral flanges on the seventh abdominal segment are widest anterior to the posterior carina on the tergite (**Fig. 3.2.421**). There is a ventral keel-like spine on the superior anal appendage of the male. The antefrons is mainly black with yellow on the antefrontal carina. The dorsal stripes on the mesanepisternum are yellow, and those on the abdomen are yellow or pale green.6

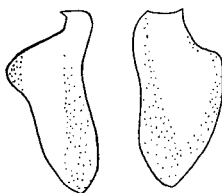


Fig. 3.2.421 The superior anal appendage of a male *Phyllopetalia pudu* in dorso-lateral (left) and dorsomedial view (right). Based on Dunkle (1985).

5. The wing blotches are faint, and less than 1/3 of the first postnodal cell of the male is red. The female does not have brown blotches on the subcostal cross veins. The posterior surface of the antefrons is obviously tumose, and that of the female is produced to within half of an ocellus diameter of the median ocellus. The antefrontal carina of the male is yellow. The occiput is rounded and transverse with its highest point on its posterodorsal surface and no median fringe of dark setae overlying its light yellow tuft. The shelf on the inferior anal appendage of the male is less than half as long as wide. Total length: 58.5 to 65.5. Abdomen length: 45 to 50 mm. Hind wing length of male: 34 to 37 mm; female: c. 42 mm. Adults were observed flying in October and November.

.....*Phyllopetalia altarensis* (Carle, 1996)
(Chile). Syn: *Eurypetalia altarensis* Carle, 1996; *Eurypetalia alterensis* Carle, 1996, alternative spelling in the same publication. It is likely that the two forms in this couplet will prove to be conspecific.

- The wing blotches are well developed, and more than 2/3 of the first postnodal cell of the male is red. The female has brown blotches on the subcostal cross veins. The posterior surface of the antefrons is only slightly tumose, and that of the female is produced to within about the length of one ocellus diameter of the median ocellus. The antefrontal carina of the male has, at most, some yellow coloration on the lateral portions. The occiput has a raised V-shaped process in the middle with a median fringe of dark setae overlying its light yellow tuft. The shelf on the inferior anal appendage of the male is more than half as long as wide. Total length: 57 to 64. Abdomen length: 44 to 50 mm. Hind wing length of male: 35 to 37 mm; female: 38 to 41 mm. Adults were observed flying from October through December.

.....*Phyllopetalia excrescens* (Carle, 1996)
(Chile). Syn: *Eurypetalia excrescens* Carle, 1996. It is likely that the two forms in this couplet will prove to be conspecific, and names may eventually turn out to be synonyms of another species. Distinguishing them on the basis of their descriptions will be extremely difficult.

6. The labrum is light brown. The height of the antefrons is 1.7 to 2.2 times the height of the postclypeus. The wings of the male have well developed dark basal markings (**Fig. 3.2.419**). There are no postoccipital horns, but dense black setae cover the occiput. The dorsal stripes on the third through sixth segments of the female abdomen are separated by the width of one stripe. The lateral flanges on the seventh abdominal segment are wider than those on the eighth. Total length: 58 to 66 mm. Length of abdomen: 43 to 50 mm. Hind wing of the male: c. 33 to 36 mm; female: 37 to 40 mm. There is a narrow yellow marking across the antefrontal carina. Adults were observed flying from September through January.

.....*Phyllopetalia stictica* Hagen in Selys, 1857
(Argentina, Chile).

- The labrum is yellow. The height of the antefrons is 1.3 to 1.7 times the height of the postclypeus. The wings of the male have only vestigial basal markings. Postoccipital horns are present, and the dense setae covering the occiput are light yellow. The dorsal stripes on the third through sixth segments of the female abdomen are separated by double the width of one stripe. The lateral flanges on the seventh and eighth abdominal tergites are about equally wide. There is wide yellow band across the anterior surface of the antefrons. The superior anal appendage of the male has a ventrobasal ridge (**Fig. 3.2.421**). Carle (1996) placed all species fitting this description in the genus *Ophiopetalia*, but none of the species he described in this genus are generally recognized as valid. It is likely that the rest of the names in this key probably should be classified as synonyms of *Phyllopetalia pudu*.7

7. The dorsal surface of the antefrons is brown. There is no subbasal lobe in a medioventral position on the superior anal appendage of the male. Total length of the male: c. 67 mm. Length of male abdomen: c. 50 mm. Hind wing length of the male: c. 39 mm. Posterior to the antecostal suture, the lateral surfaces of the

third through sixth abdominal segments of the male are golden brown. The female has not been described.

.....*Phyllopetalia auregaster* (Carle, 1996)
(Chile). Syn: *Ophiopetalia auregaster* Carle, 1996. Probably a synonym of *Phyllopetalia pudu*. The differences found in the descriptions normally fall within intraspecific variation.

- The dorsal surface of the antefrons is black. There is a subbasal lobe in a medioventral position on the superior anal appendage of the male (**Fig. 3.2.421**). Posterior to the antecostal suture, the lateral surfaces of the third through sixth abdominal segments of the male are dark brown or black.8
8. The anterior margin of the triangle in the hind wing is 1.1 to 1.3 times as long as the proximal margin. The darkening over the costal brace of the wing is almost as large as the darkened area over the brace vein at the pterostigma. The superior anal appendage of the male has a ventrobasal ridge that extends posteriad to form a rounded basal angulation (**Fig. 3.2.421**). Total length: 66 to 72 mm. Length of abdomen: 49.5 to 56 mm. Hind wing of the male: 37 to 40 mm; female: 41.5 to 43.5 mm. Adults were observed flying in November and December.

.....*Phyllopetalia pudu* Dunkle, 1985
(Argentina, Chile).

- The anterior margin of the triangle in the hind wing is 1.3 to 1.5 times as long as the proximal margin. The darkening over the costal brace of the wing is obviously smaller than the darkened area over the brace vein at the pterostigma. The superior anal appendage of the male lacks a ventrobasal ridge that extends posteriad to form a rounded basal angulation.9
9. The dorsal stripes on the mesanepisternum are six times as long as wide, and the lateral mesanepisternal stripes are vestigial. The length of the pterostigma on the fore-wing of the female is about 3 mm. There is a wide groove between the ventral carinae and the basal lobe of the superior anal appendage of the male. Total length: 68 to 74 mm. Length of abdomen: 53 to 57 mm. Hind wing length: 40 to 43 mm. Adults were observed flying in November and December.

.....*Phyllopetalia araucana* (Carle, 1996)
(Chile). Syn: *Ophiopetalia araucana* Carle, 1996. Probably a synonym of *Phyllopetalia pudu*.

- The dorsal stripes on the mesanepisternum are three to four times as long as wide, and the lateral mesanepisternal stripes are about half as long as the dorsal stripes and oval in shape. The length of the pterostigma on the fore-wing of the female is about 4 mm. There is a narrow groove between the ventral carinae and and basal lobe of superior anal appendage of the male. Total length: 60 to 69 mm. Length of abdomen: 46 to 54 mm. Hind wing length of male: 37 to 39 mm; female: 39 to 42 mm. Adults were observed flying from November through early February.

.....*Phyllopetalia diana* (Carle, 1996)
(Chile). Syn: *Ophiopetalia diana* Carle, 1996. Probably a synonym of *Phyllopetalia pudu*.

Aeshnidae

Key to the genera of adults in South America

Information for the key was provided by Schmidt (1942), Rácinis (1953b), Calvert (1956, 1958), Smith and Pritchard (1963), Carvalho (1992a, b), DeMarmels (1994b), and von Ellenrieder (2003).

1. Vein R_3 bends strongly just posterior to the distal end of the pterostigma. The upper sector of the arculus is shorter than the lower sector. The hind wing of the male lacks an anal triangle and an anal angle (**Fig. 3.2.422**).

.....*Anax* Leach, 1815..p. 399
 - Vein R_3 curves evenly posterior to the pterostigma. The upper sector of the arculus is as long or longer than the lower sector. The hind wing of the male has an anal triangle and an anal angle (**Fig. 3.2.423**).2

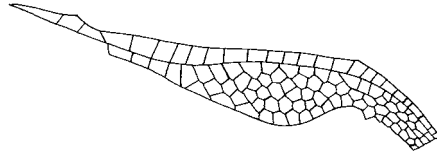


Fig. 3.2.422 Vein R_3 and the veins posterior to it in *Anax amazili*, showing the characteristic sharp bend. Based on von Ellenrieder (2002), who designated the vein as RP_2 , according to a different classification system.

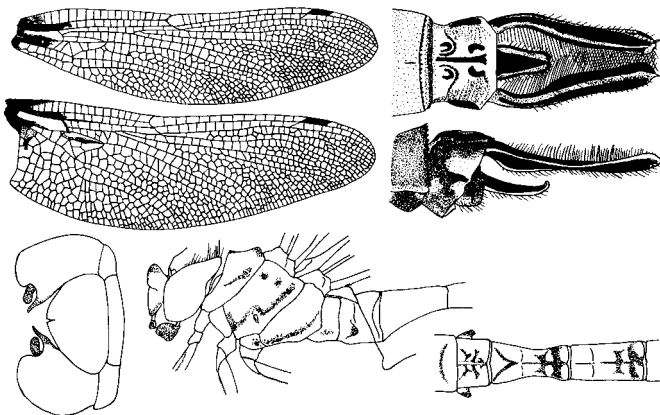


Fig. 3.2.423 *Allopetalia reticulosa*: fore and hind wing (upper left); apex of the male abdomen in dorsal (upper right) and lateral view (middle right); prementum in ventral view (lower left); head, thorax, and anterior segments of the abdomen in lateral view (lower center), and the first four segments of the abdomen in dorsal view (lower right). Based on Martin (1909), Ris (1909), and von Ellenrieder (2002).

2. Vein IR_3 , the radial sector, does not fork. There are no processes or denticles on the ventral surface of the tenth abdominal segment of the female. The crest of the frons is greatly elevated to form an obtuse cone. The femerotibial joints are black (**Fig. 3.2.423**).

.....*Allopetalia* Selys, 1873..p. 402
 - Vein IR_3 forks (**Fig. 3.2.424**). There are processes or denticles on the ventral surface of the tenth abdominal segment of the female.3

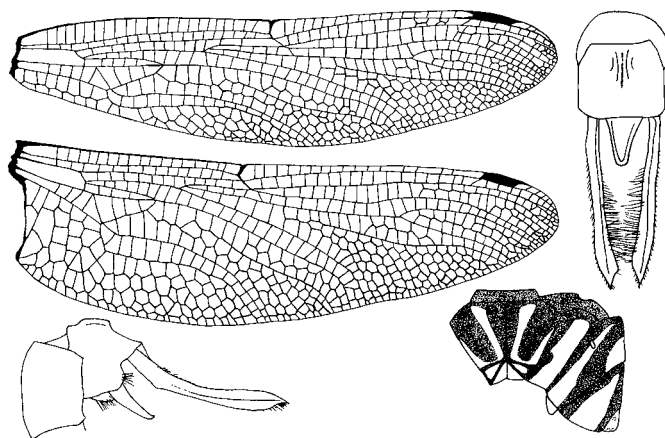


Fig. 3.2.424 *Limnetron antarcticum* male: fore and hind wing (upper left), diagram of the color pattern on the synthorax (lower right), and apex of the abdomen in dorsal (upper right) and lateral view (lower left). Based on Ris (1913c).

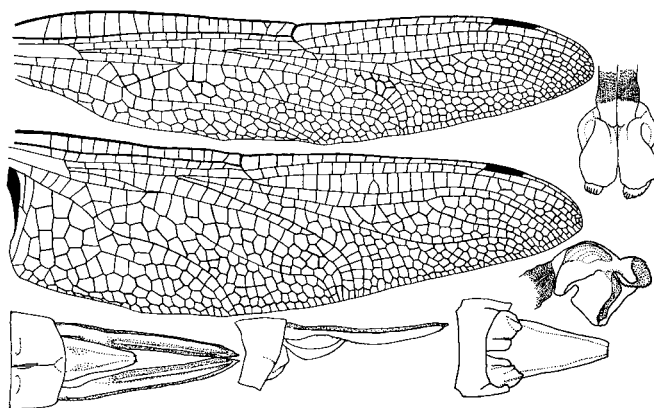


Fig. 3.2.425 *Andaeschna andresi*: fore and hind wing (upper left), apex of the male abdomen in dorsal (lower left) and lateral view (lower center), epiproct of a male (lower right), and apex of the penis in ventral (upper right) and lateral view (middle right). Based on DeMarmels (1994b).

3. Veins MA and R_{4+5} run parallel from the origin of MA to the margin of the wing. There are four to eight pronged processes on the ventral side of the tenth abdominal segment of the female (**Fig. 3.2.424**).4
 - Vein MA is interrupted or forked and fuses with R_{4+5} near the midpoint of that vein. There are denticles or two to three pronged processes on the ventral side of the tenth abdominal segment of the female (**Fig. 3.2.425**).5

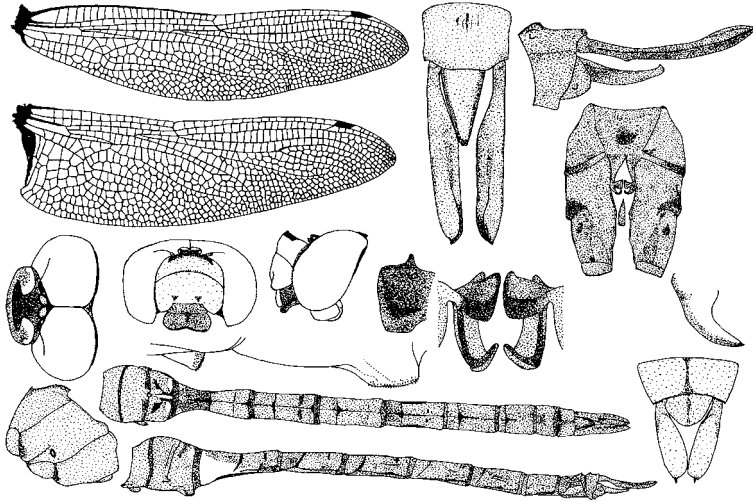


Fig. 3.2.426 *Rhionaeschna draco*: fore and hind wing (upper left); head in dorsal, frontal, and lateral view (middle left, left to right); color pattern on the synthorax of a male in lateral view (lower left), lateral profile of the ventral tubercle on the first abdominal segment and male genitalia of the second (below head); ventral view of the first and second abdominal segments of a male (upper middle right); hamular lobes in posterior (right of center) and lateral view (center); color pattern on the male abdomen in dorsal and lateral view (lower center, above and below, respectively) and its apex in dorsal (upper right center) and lateral view (upper right); apex of the female abdomen (lower right); spine on the anterior lamina (lower middle right). Based on von Ellenrieder (2003).

4. The fork in vein IR_1 is separated from vein R_{sp1} by three cell rows. The anal loop of the hind wing contains 11 to 13 cells. The tenth abdominal segment of the female is armed with a ventral process bearing four sharp spines (**Figs. 3.2.5, 3.2.6**). The female is mainly brown and yellow with green markings. The male has not been described. Total length: c. 75 mm. Length of abdomen: c. 53 mm. Hind wing length: c. 50 mm.

.....*Racenaeschna* Calvert, 1958
 The only species presently assigned to this genus is *Racenaeschna angustistrigis* Calvert, 1958, from Venezuela and Bolivia.

- The fork in vein IR_3 in both wings is separated from vein R_{spl} by one or two rows of cells. The anal loop of the hind wing contains 6 to 9 cells (**Fig. 3.2.424**). The discoidal triangle in the fore-wing contains three or four cells. The anal loop in the fore-wing contains eight or nine cells, and that in the hind wing contains three. There are four or five discoidal cells at the distal side of the triangle in the front and hind wings. The internal triangle of the fore-wing consists of only one cell. There are three or four supratrangular cross veins in the fore-wing. The tenth abdominal segment of the female is armed with six ventral spines.

.....*Limnetron* Förster, 1907..p. 403
 5. In the male, the anal angle of the hind wing is rounded, and the proximal and distal veins in the anal triangle join at a single point rather than fusing before reaching the angle. There is no T-spot on the frons. There is no mid-ventral tubercle on the first abdominal segment. The thorax and abdomen are fairly uniform in color and lack a distinct pattern. The posterior junction of the arculus in the fore-wing is more distant than its own length from the base of the triangle. The third abdominal segment of the female is not constricted, and that of the male is only slightly constricted. There are no ventroposterior lateral lobes on the penis (**Fig. 3.2.425**).

.....*Andaeschna* DeMarmels, 1994..p. 404
 - In the male, the proximal and distal veins in the anal triangle fuse before reaching the angle (**Fig. 3.2.326**).6

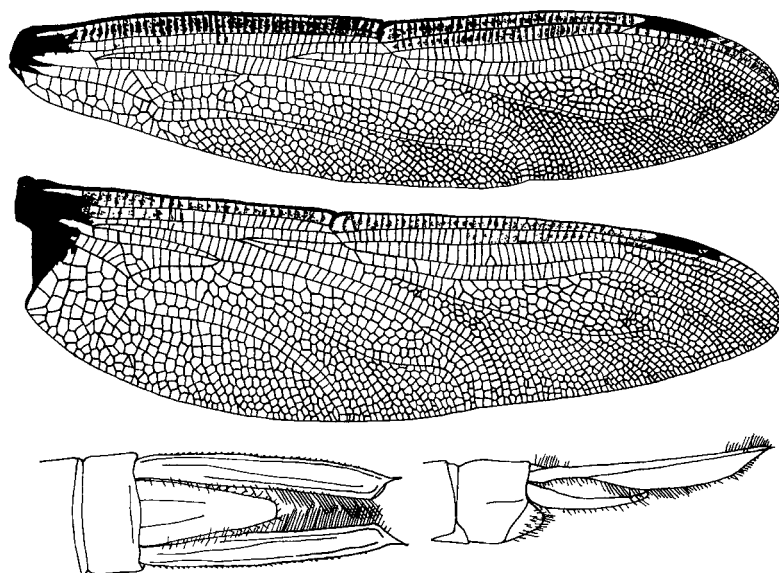


Fig. 3.2.427 *Gynacantha membranalis* male: fore and hind wing (above) and the apex of the abdomen in dorsal (lower left) and lateral view (lower right). Based on Williamson (1923b).

6. The proximal cell of each discoidal triangle is free (**Fig. 3.2.426**).7
 - The proximal cell of each discoidal triangle is crossed (**Fig. 3.2.427**).10
 7. There is a conical tubercle bearing denticles on the ventral surface of the first abdominal segment. Vein IR₃ has a symmetrical fork usually proximal to the pterostigma. The length of the discal triangle is no more than 2.5 times the width. There is a T-shaped spot on the frons. The anal triangle of the male consists of three cells (**Fig. 3.2.426**).
*Rhionaeschna* Förster, 1909 pars..p. 407
 - If there is a tubercle on the first abdominal segment, it is cylindrical and bears no denticles. Vein IR₃ is asymmetrical and usually forks directly posterior to the proximal end of the pterostigma or distal from that point. The anal triangle of the male consists of two cells (**Fig. 3.2.428**).8
 8. There is a cylindrical median tubercle without denticles on the sternite of the first abdominal segment. Each posteroventral tergal angle of the first abdominal segment of the male is prolonged into an acute tooth that projects mesad (**Fig. 3.2.428**).
*Castoraeschna* Calvert, 1952..p. 460
 - There is no median tubercle on the first abdominal sternite. The posteroventral tergal angles of the first abdominal segment of the male are prolonged into tooth-like processes (**Fig. 3.2.429**).9

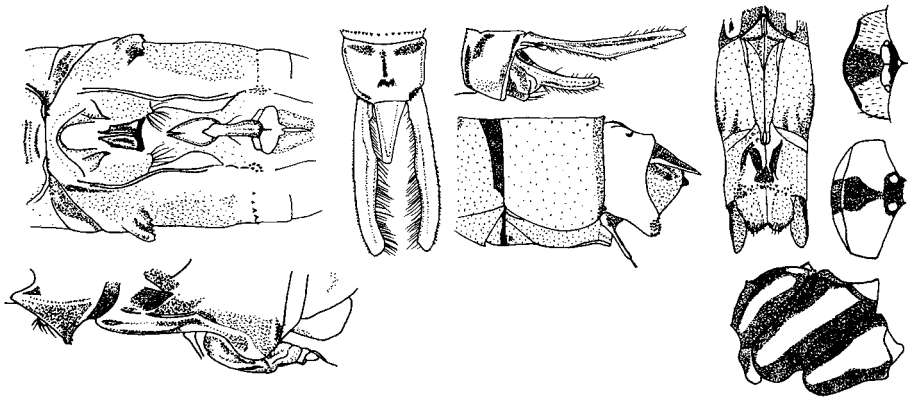


Fig. 3.2.428 *Castoraeschna colorata*: color pattern on the vertex and frons of a male (upper right) and a female (middle right), color pattern on the thorax of a male in lateral view (lower right), male genitalia on the second abdominal segment in ventral view (upper left) and the same genitalia with the tubercle on the first abdominal segment in lateral view (lower left), apex of the male abdomen in dorsal (left center) and lateral view (upper center), apex of the female abdomen in ventral (upper right center) and lateral view (lower center). Based on Calvert (1956).

9. Vein Rspl is separated from vein IR₃ by one row of cells near its distal end, and it reaches the wing margin. Vein A₃ in the hind wing of the male reaches the wing margin proximal to the anal angle. The superior anal appendage of the female is roughly equal to the combined lengths of the eighth through tenth abdominal segments or even longer (**Fig. 3.2.429**).

.....*Coryphaeschna* Williamson, 1903..p. 467

- Vein Rspl is separated from vein IR₃ by two rows of cells at the point where it fades out before reaching the wing margin. Vein A₃ in the hind wing of the male reaches the wing margin distal to the anal angle. The superior anal appendage of the female is roughly equal only to the length of the tenth abdominal segment (**Fig. 3.2.430**).

.....*Remartinia* Navás, 1911..p. 472

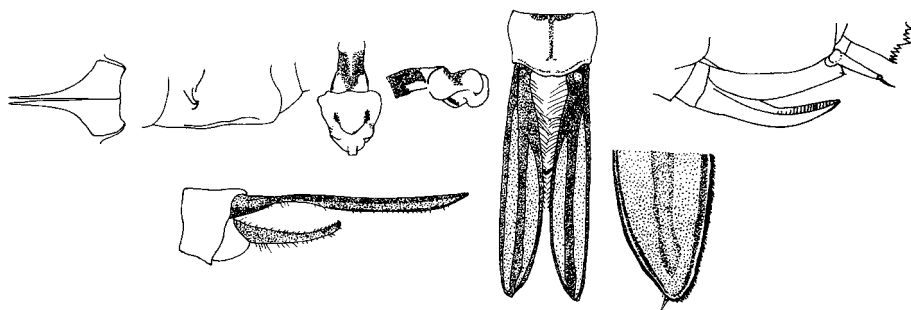


Fig. 3.2.429 *Coryphaeschna huaorania* (above, left to right): processes on the anterior hamule; lateral view of the second abdominal segment of the male, showing the auricle at left and genital lobe at right; apex of the penis in dorsal and lateral view, apex of the male abdomen in dorsal view; ovipositor of a female specimen in lateral view, and (below, left and right, respectively): apex of the male abdomen in lateral view, and apex of the superior anal appendage of a male in dorsal view. Based on Tennessen (2001).

10. The midbasal space in the hind wing is equal to or longer than the supratriangle (**Fig. 3.2.427**).11

- The midbasal space in the hind wing is shorter than the supratriangle (**Fig. 3.2.431**).12

11. There is only one row of cells between veins Cu₂ and A₁ in the hind wing, which has an indistinct membranule visible only at the anal base. There is a two-spined process on the ventral side of the tenth abdominal segment of the female (**Fig. 3.2.427**).

.....*Gynacantha* Rambur, 1842 pars..p. 474

Species of small *Gynacantha* may key out here. One of these was formerly placed in its own genus, *Subaeschna* Martin, 1909, which is treated here as a synonym of *Gynacantha*, *fide* Paulson and von Ellenrieder (2005).

- There are two rows of cells between veins Cu_2 and A_1 in the hind wing, which has a distinct membranule bordering more than half of the wing base. There is no two-spined process on the ventral side of the tenth abdominal segment of the female.

.....*Aeshna* Fabricius, 1775
Some species of *Aeshna* would reach this point in the key, but all South American species formerly classified in this genus have been transferred to other genera, with *Rhionaeschna* (Couplet 7) encompassing those species with prominent mid-ventral tubercles on the first abdominal segment and *Andaeschna* (Couplet 5) being assigned to the species without this prominent tubercle.

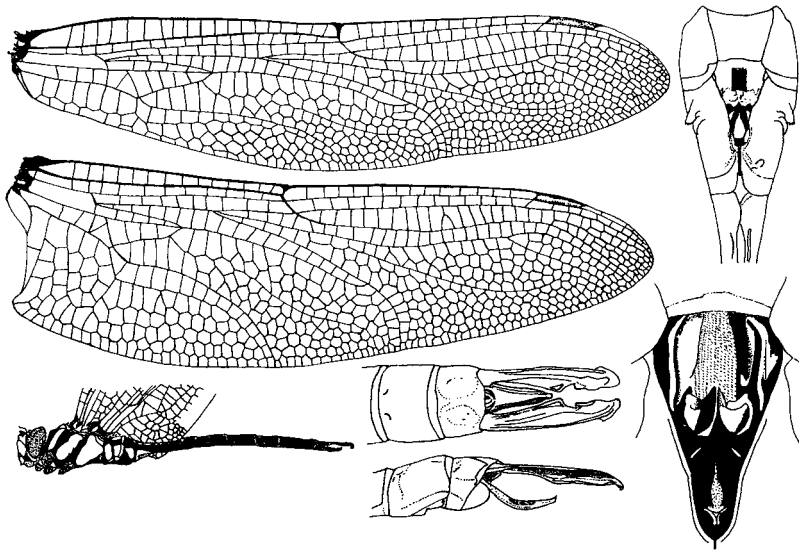


Fig. 3.2.430 *Remartinia rufipennis* male: fore and hind wing (upper left); lateral view showing the color pattern (lower left); first and second abdominal segments in ventral view with an enlargement of the sexual organs (right, top and bottom, respectively); and the apex of the abdomen in dorsal and lateral view (lower center, above and below, respectively). Based on Kennedy (1941).

12. Posterior to the midlength of the pterostigma of the hind wing or more distal to that point, veins R_2 and R_3 begin to be separated by two rows of cells. The ventral process on the tenth abdominal segment of the female has three prongs (**Fig. 3.2.431**).

.....*Triacanthagyna* Selys, 1883..p. 490
- Veins R_2 and R_3 begin to be separated from each other by two rows of cells at a point posterior to the basal end of the pterostigma or more proximal to that point. The ventral process on the tenth abdominal segment of the female has two prongs (**Fig. 3.2.432**).13

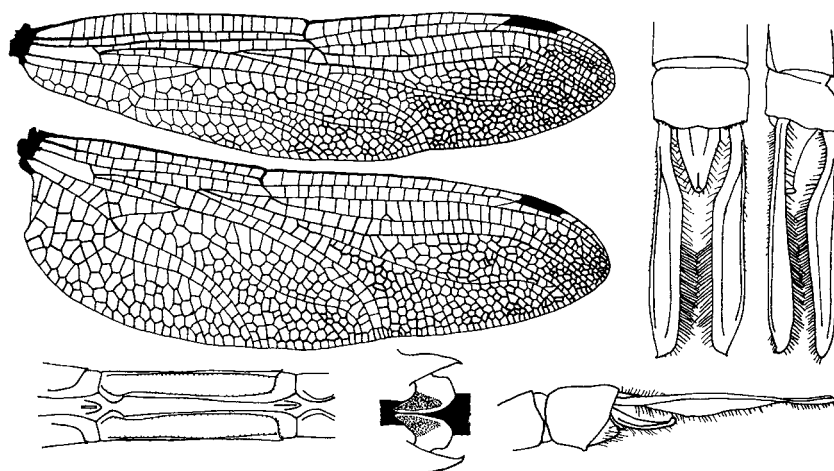


Fig. 3.2.431 *Triacanthagyna caribbea*: fore and hind wing (upper left), the apex of the abdomen of a male in dorsal (upper right center), dorso-internal (upper right), and lateral view (lower right), hamular processes (lower center), and third abdominal segment of a female in ventral view (lower left). Based on Williamson (1923b).

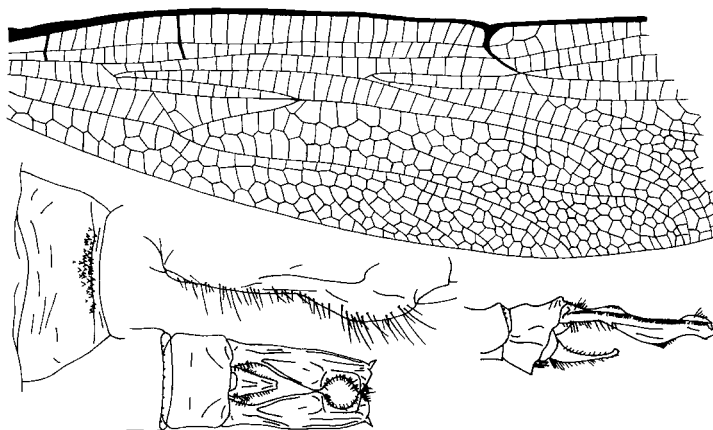


Fig. 3.2.432 *Neuraeschna clavulata* male: basal $\frac{3}{4}$ of the fore-wing (above), first abdominal segment in ventral view (lower left), genital region of the second abdominal segment in lateral view (center), and the apex of the abdomen in dorsal (lower center) and lateral view (lower right). Based on Machet (1990).

13. Vein Sc does not extend beyond the nodus. There is a two-spined process on the ventral side of the tenth abdominal segment of the female (**Fig. 3.2.427**).

.....*Gynacantha* Rambur, 1842 pars..p. 474

- Vein Sc extends through the nodus and beyond. There is no two-spined process on the ventral side of the tenth abdominal segment of the female (**Fig. 3.2.432**).

.....14
14. Reticulations are present in the midbasal space. There are cross veins proximal to the first primary antenodal cross vein (**Fig. 3.2.432**).

.....*Neuraeschna* Hagen, 1867..p. 499
- The midbasal space lacks reticulations, although it may sometimes be crossed by one cross vein. There are no cross veins proximal to the first primary antenodal cross vein (**Fig. 3.2.433**).

.....*Staurophlebia* Brauer, 1865..p. 509

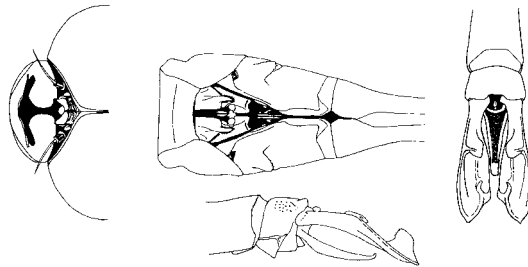


Fig. 3.2.433 *Staurophlebia auca* male: markings on the anterior part of the head (left), genitalia on the second abdominal segment in ventral view (upper center), and the apex of the abdomen in dorsal (right) and lateral view (lower center). Based on Kennedy (1937).

Key to the genera of known larval Aeshnidae in South America

Information for the key was provided by Smith and Pritchard (1963), Carvalho (1989), and DeMarmels (1990a, 1994, 2000). No description of a *Remartinia* larva is available.

1. The caudal appendages have spines along their carinae and are not bifid at the apices, and the occipital lobes are rounded. There is a low tooth on each side of the median cleft of the prementum, which is irregular in shape and slightly longer than the spines in the rows along the prementum. The hook at the apex of the labial palp is only slightly larger than the teeth in the adjacent row, which number about 30 (**Fig. 3.2.434**).

.....*Allopetalia* Selys, 1873..p. 402

- The caudal appendages do not have spines along the carinae, or they are bifid at the apices, or the occipital lobes are rounded. There is either a prominent spine on each side of the median cleft of the prementum, or there is a tubercle lower than the spines in the adjacent row. If any hook is present at the apex of the labial palp, it is prominent (**Fig. 3.2.435**).2

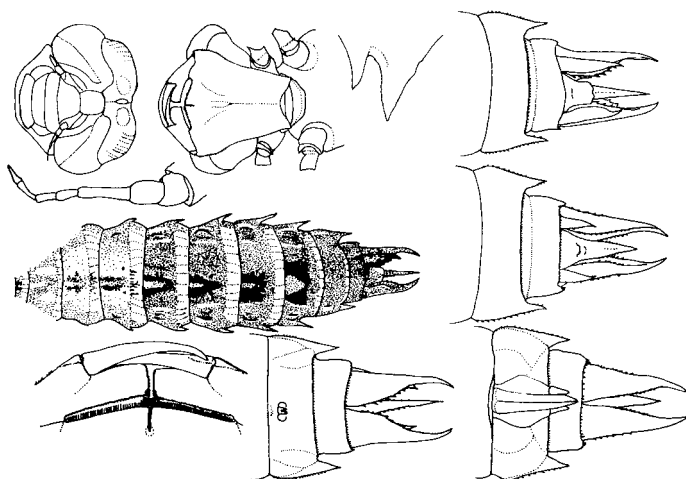


Fig. 3.2.434 *Allopetalia pustulosa* larva: head of a female in dorsal (upper left) and ventral view (upper left center), middle of the prementum and labial palps of a male (lower left), antenna of a male (upper middle left), apophyses of a male prothorax (upper right center), dorsal surface of the abdomen of a male (lower middle left), apex of a male abdomen in dorsal (upper right) and ventral view (middle right), and the apex of a female abdomen in dorsal (lower center) and ventral view (lower right). Based on DeMarmels (2000).

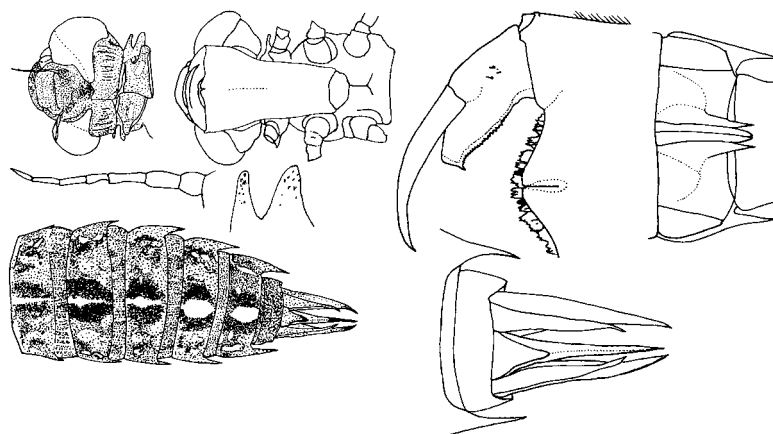


Fig. 3.2.435 *Racenaeschna angustistrigis* larva (above, left to right): head of a male in dorsal view, same head and thorax showing the labium in ventral view, labial palp and anterior margin of the prementum of a male in dorsal view, gonapophyses on the ninth abdominal segment of a female in ventral view, and the antenna (middle left), supracoxal process on the prothorax of a male (right of antenna), dorsal view of the abdomen of a male (lower left), and apex of the male abdomen in dorsal view (lower right). Based on DeMarmels (1990a).

2. There is a thick, blunt tooth on either side of the middle indentation of the prementum. When folded under the head, the labium reaches as far posteriad as the anterior margin of the hind coxa. The femora have dark bands, and there is a distinct pattern on the abdomen. There are lateral spines on the fifth through ninth abdominal segments, increasing in size posteriad (**Fig. 3.2.235**). Those on the ninth segment of the males extend beyond the apex of the tenth segment, but those of the female larvae do not. Total length of the only known South American species: 37 to 38 mm.

.....*Racenaeschna* Calvert, 1958

The only species presently assigned to this genus is *Racenaeschna angustistrigis* Calvert, 1958, from Venezuela and Bolivia.

- There is either a pointed spine, a low tubercle, or no process on either side of the middle indentation of the prementum (**Fig. 3.2.436**).3

3. There is a pointed spine on each side of the middle indentation of the prementum. These are obviously larger than the hair-like setae fringing the median lobe of the prementum. There is a well developed hook at the end of the blade on the labial palp (**Fig. 3.2.436**).4

- If any processes are present on each side of the middle indentation of the prementum, they are low and tubercular and never longer than the setae fringing the median lobe of the prementum. There is no obvious end hook at the end of the blade on the labial palp (**Fig. 3.2.437**).7

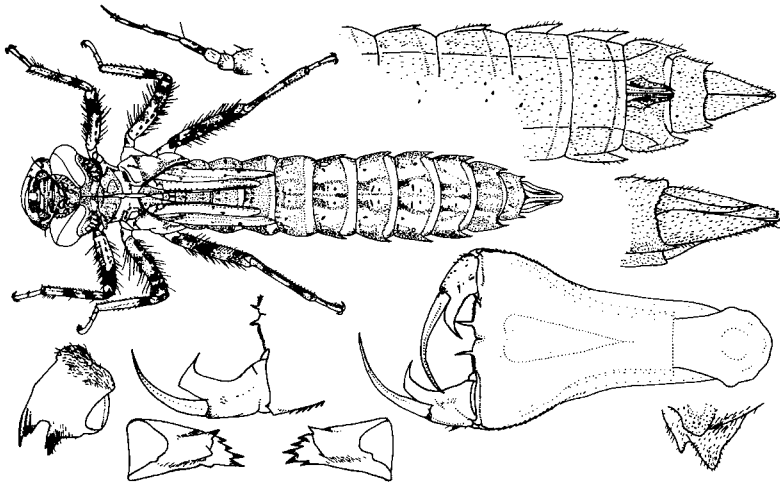


Fig. 3.2.436 *Neuraeschna costalis* female last instar larva: habitus from exuvia with an enlarged antenna above it (upper left), dorsal view of the right mandible (lower left), the inner surfaces of the mandibles (lower left center), labial palp and left side of the prementum (above mandibles), labium (lower right center), lateral processes of the prothorax in dorsal view (lower right), ventral view of the apical segments of the abdomen (upper right), and caudal appendages in lateral view (upper middle right). Based on Carvalho (1989).

4. The tenth abdominal segment bears lateral spines. There is a longitudinal row of blackish spots on the dorsal side of each femur near the base. There is a lateral spiny lobe on the mandible (**Fig. 3.2.436**).5
- The tenth abdominal segment does not bear lateral spines. There is no longitudinal row of blackish spots on the dorsal side of each femur. There is no lateral spiny lobe on the mandible (**Fig. 3.2.238**).6

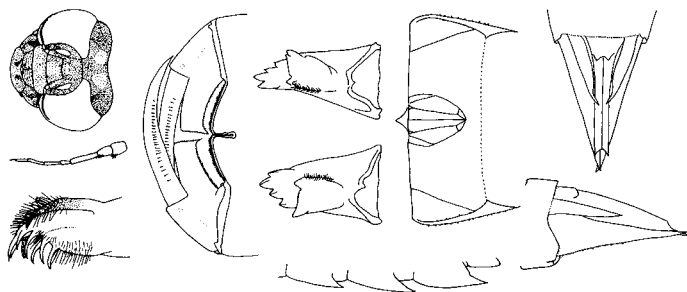


Fig. 3.2.437 *Anax concolor* larva: head in dorsal view (upper left), antenna (middle left), apex of the maxilla in ventral view (lower left), anterior part of the labium (left center), mandibles (upper center), lateral margin of the seventh through ninth abdominal segments in dorsal view (lower center), ninth segment of a female larva in ventral view (upper right center), and the caudal appendages in dorsal (upper right) and lateral view (lower right). Based on Geijskes (1968).

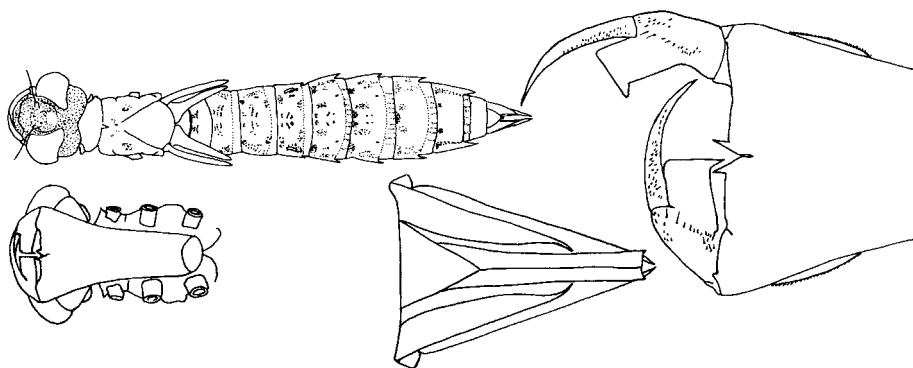


Fig. 3.2.438 *Gynacantha gracilis* larva: dorsal view of the body without the legs (upper left), labium folded against the head and thorax in ventral view (lower left), anterior portion of the labium in dorsal view (right), and apex of the abdomen in dorsal view (lower center). Based on Santos (1973d).

5. There are no tubercles on the dorsal surfaces of the head and thorax and no dorsal hooks on the abdominal segments (**Fig. 3.2.436**).

.....*Neuraeschna* Hagen, 1867..p. 499

- The dorsal surfaces of the head and thorax are covered with tubercles, and the ninth and tenth abdominal segments bear small dorsal hooks (**Fig. 3.2.239**).

.....*Staurophlebia* Brauer, 1865..p. 509

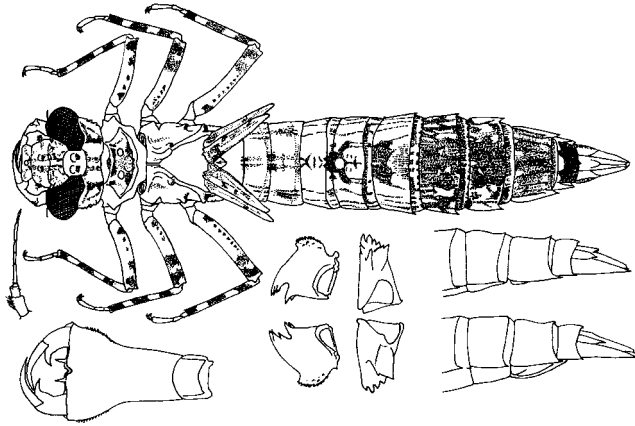


Fig. 3.2.439 *Staurophlebia reticulata* larva: habitus of a male (above), antenna from a female exuvium (middle left), mentum of a female (lower left), mandibulae in dorsal (lower left center) and inner view (lower right center), and a lateral view of the apex of the male (middle right) and female abdomen (lower right). Based on Geijskes (1959).

6. The posterior corners of the head are curved. The blade of the labial palp is truncate to form nearly right angles, and it has a row of tiny setae on its dorsal surface. Black spots on the femora do not form a ring (**Fig. 3.2.438**).

.....*Gynacantha* Rambur, 1842 pars..p. 474

- The posterior corners of the head form angles. The blade of the labial palp narrows toward the apex, and it lacks a row of tiny setae on its dorsal surface. Black spots on the femora form a ring on the apical third (**Fig. 3.2.440**).

.....*Coryphaeschna* Williamson, 1903 pars..p. 467

7. When in the normal retracted position beneath the thorax, the labium reaches posteriad as far as the hind coxae. There are lateral spines on only the seventh through ninth abdominal segments. The male larva has a basal tubercle with a truncate or concave apex on the epiproct (**Fig. 3.2.437**).

.....*Anax* Leach, 1815..p. 399

- When in the normal retracted position beneath the thorax, the labium reaches posteriad only as far as the middle coxae. There are lateral spines on the sixth abdominal segment. The male larva has a basal tubercle on the epiproct with a pointed or blunted apex (**Fig. 3.2.441**).8

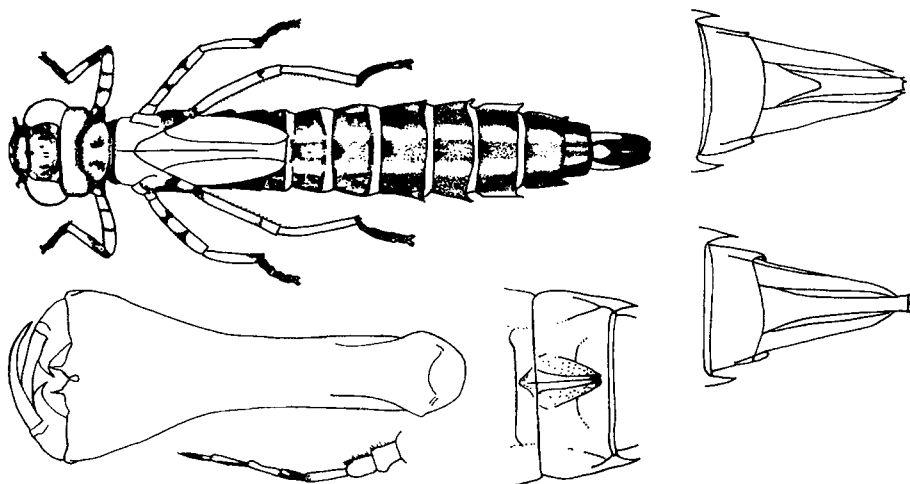


Fig. 3.2.440 *Coryphaeschna viriditas* larva: habitus of the final larval instar of a male (upper left), mentum in dorsal view (middle left), antenna (lower left), gonapophyses of a female larva (lower center), and dorsal views of the apices of the male (upper right) and female abdomen (lower right). Based on Giejskes (1943), who designated the species by its synonym, *Coryphaeschna virens*.

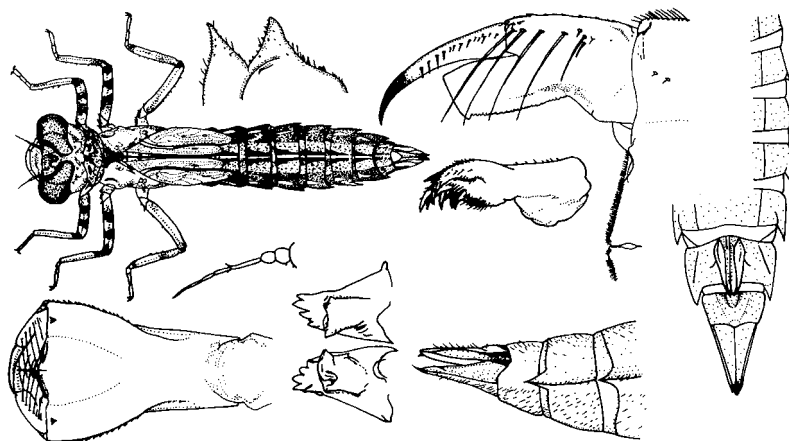


Fig. 3.2.441 *Triacanthagyna ditzleri* larva: habitus (upper left), antenna (below center of habitus), supracoxal process of the prothorax in dorsal view (upper left center), labium (lower left), anterior margin of the prementum and labial palp (upper right center), mandibles in interior view (lower left center), maxilla (right center), left margin of the abdomen and apical abdominal segments in ventral view (right), apical segments of the abdomen in lateral view (lower right center). Based on Carvalho (1988).

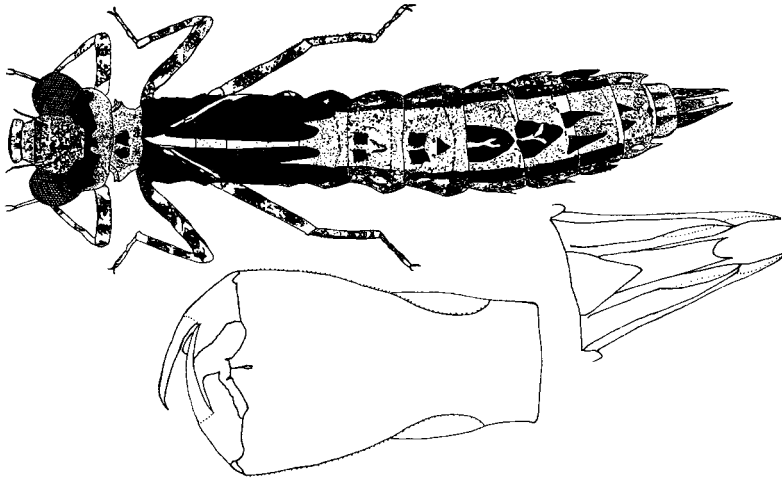


Fig. 3.2.442 *Limnetron debile* larva: habitus from an exuvia (above), labium in ventral view (lower center), and apex of the abdomen in dorsal view (lower right). Based on Santos (1970c).

8. The blade of the labial palp has well developed setae forming a row on the dorsal surface; the apical setae are longest, their length equaling or surpassing the width of the blade (**Fig. 3.2.441**).9

- If any setae are present on the blade of the labial palp, they are small and do not form a row; the apical setae are longest. End hooks are not developed on the labial palps (**Fig. 3.2.442**).10

9. If any end hooks are present on the labial palps, they are poorly developed. The lateral setae of the labium are well developed, and at least the four distal ones are nearly uniform in length. Lateral spines are present on the fifth abdominal segment (**Fig. 3.2.441**).

.....*Triacanthagyna* Selys, 1883 pars..p. 490

- The end hook on the labial palp is strongly developed. The lateral setae of the labium decrease progressively in length toward the proximal end of the row. The fifth abdominal segment does not have lateral spines (**Fig. 3.2.438**).

.....*Gynacantha* Rambur, 1842 pars..p. 474

10. There are lateral spines on the fifth abdominal segment. There is a small, blunt spine on each side of the middle indentation of the prementum. On the dorsal surfaces of the fourth through eighth abdominal segments, there are dark markings along the midline that are roughly triangular in shape, sometimes with lighter markings near the middle (**Fig. 3.2.442**). If the general color is too dark to permit these markings to be clearly distinguished, at least that on the eighth segment is evident.

.....*Limnetron* Förster, 1907..p. 403

- There are no lateral spines on the fifth abdominal segment. If any processes at all are present on each side of the middle indentation of the prementum, they are very small tubercles (**Fig. 3.2.443**).11

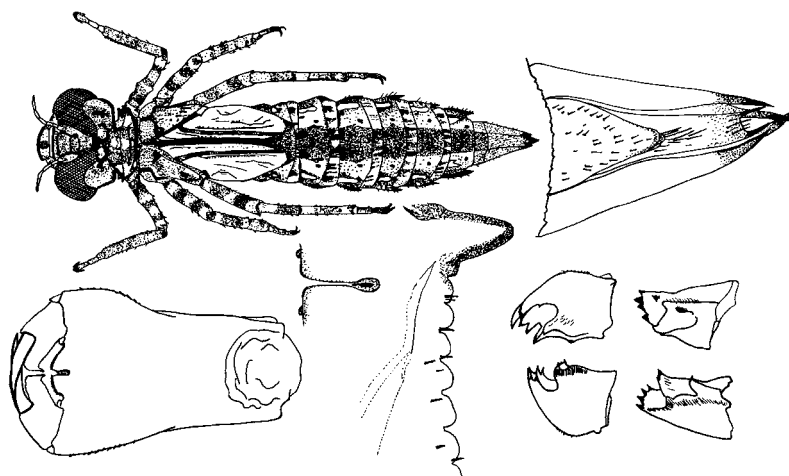


Fig. 3.2.443 *Castoraeschna decurvata* larva: habitus (upper left), labium (lower left) with an enlargement of the median indentation in the prementum (left center), end tooth and smaller teeth in the row along the inside border of the labial palp (lower center), mandibles in posterior (lower right center) and median view (lower right), and apex of the abdomen of a male larva in dorsal view. Based on Rodrigues Capítulo and Jurzitza (1989).

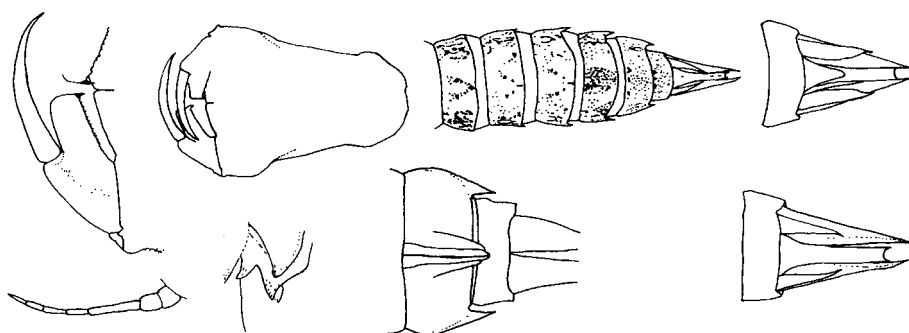


Fig. 3.2.444 *Andaeschna rufipes* larva (upper row, left to right): left palp of the labium in dorsal view, labium, color pattern on the dorsal side of the abdomen, and the apex of the male abdomen in dorsal view, and (lower row, left to right): antenna, apophysis on the left side of the prothorax in dorsal view, apical segments of the abdomen of a female larva in ventral view, and apex of the female abdomen in dorsal view. Based on DeMarmels (1982b).

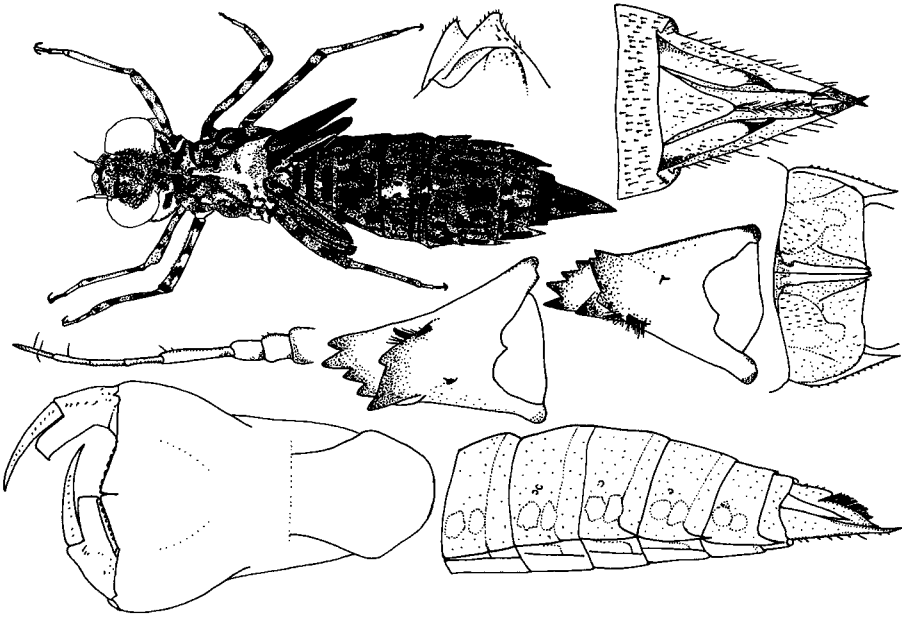


Fig. 3.2.445 *Rhionaeschna pauloi* larva: habitus from an exuvia (above left) of a male larva, antenna (middle left), labium in dorsal view (lower left), supracoxal processes of the prothorax in dorsal view (upper center), mandibles in interior view (center and right of center), apex of the abdomen of a male in dorsal view (upper right), apical abdominal segments of a male in lateral view, and a ventral view of the ninth abdominal segment of a female larva (middle right). Based on Carvalho and Salgado (2002).

11. There are two lateral spines at the apex of the epiproct, which is slightly shorter than the cerci (**Fig. 3.2.443**).

.....*Castoraeschna* Calvert, 1952..p. 460
 - The epiproct is as long or longer than the cerci (**Fig. 3.2.440**).12

12. The epiproct lacks a median dorsal ridge and is truncate at the apex. It is only slightly longer than the superior appendages. There are no distinct dark triangular markings on the dorsal surface of the fourth through eighth abdominal segments (**Fig. 3.2.440**).

.....*Coryphaeschna* Williamson, 1903 pars..p. 467
 - The epiproct has a mid-dorsal ridge and pointed apices or one or two shallow indentations that form two or three short spines. They are clearly longer than the cerci (**Fig. 3.2.444**).13

13. There is no obvious pattern of longitudinal bands. Large pale mid-dorsal markings are present on the dorsal surfaces of the sixth and seventh abdominal segments. The fifth and eighth abdominal segments are obviously darker than the sixth and seventh segments. There are lateral spines on the sixth through ninth abdominal segments. The caudal pyramid is longer than the combined length of the two apical segments of the abdomen (**Fig. 3.2.444**). The final instar larva is at least 41 mm long.

.....*Andaeschna* DeMarmels, 1994
 - There is usually an obvious pattern of longitudinal bands (**Fig. 3.2.445**). Distinguishing the larvae of *Andaeschna* and *Rhionaeschna* will remain tentative until all of the larvae have been described.

.....*Rhionaeschna* Förster, 1909 pars..p. 407

Key to the species of adult *Anax* in South America

Information for the key was provided by Geijskes (1968) and Pastor (1968). Not included in the key is *Anax ephippiger* (Burmeister, 1839), a widespread species throughout much of the world, which was recently reported from French Guiana. The one specimen that was collected seems to be a stray, introduced somehow by winds or transported by man. Established populations of this species are not known to exist in South America. In general, species of *Anax* are wide-ranging, and there has been considerable disagreement about the identity of the species encountered in South America. For example, Geijskes (1968) reported that *A. longipes* is a West Indian species not encountered in South America but that *A. concolor* commonly occurs on that continent. However, Rodrigues Capítulo (1981) reported that only *A. longipes* and *A. amazili* occur in South America, basing his information on identifications made by Byers (1927) and Calvert (1934). Geijskes (1968) had reported that some identifications by Calvert had been erroneous. The situation is made more complicated by the fact that Geijskes (1968) had found no reliable way to distinguish the adults of *A. concolor* from those of *A. amazili*, although differences in the larvae seem to indicate that they are distinct species. At the present time, it is assumed that *A. concolor* and *A. amazili* are distinct and present in South America, while the occurrence of stable populations of *A. longipes* on that continent is questionable. A comprehensive study of the genus would be desirable.

1. The abdomen is marked to some degree with red. The frons is uniform in color and without dark markings (**Fig. 3.2.446**). The wings are uniformly brownish or hyaline. Total length: 75 to 83 mm. Length of abdomen with appendages: 53 to 59 mm. Hind wing length: 47 to 52 mm. Length of hind femur: 14 to 16 mm.

.....*Anax longipes* Hagen, 1861
 (North America, West Indies, Argentina?, Mato Grosso?).

- The abdomen is mainly green or blue and never red. The dorsal part of the frons may have dark markings (**Fig. 3.2.447**).2

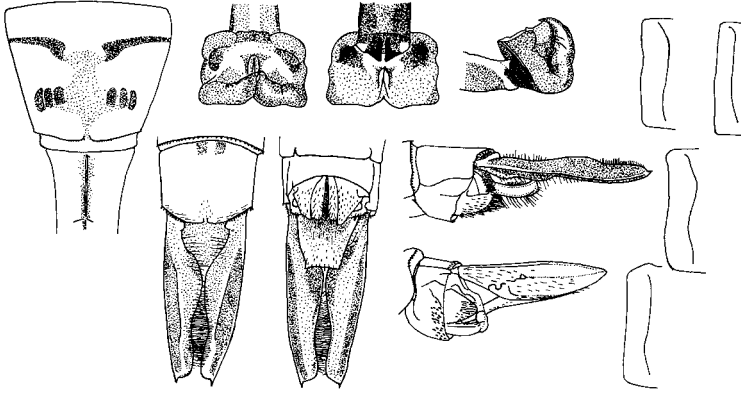


Fig. 3.2.446 *Anax longipes*: second abdominal segment of the male in dorsal view (upper left), apex of the penis in dorsal, ventral, and lateral view (upper middle, left to right), apex of the abdomen of a male in dorsal (lower left), ventral (lower left center), and lateral view (middle right center), apex of the abdomen of a female in lateral view (lower right center), and the lateral and ventral carinas on the one side of the fourth through seventh abdominal segments of a female (right, above to below and far right, respectively). Based on Geijskes (1968).

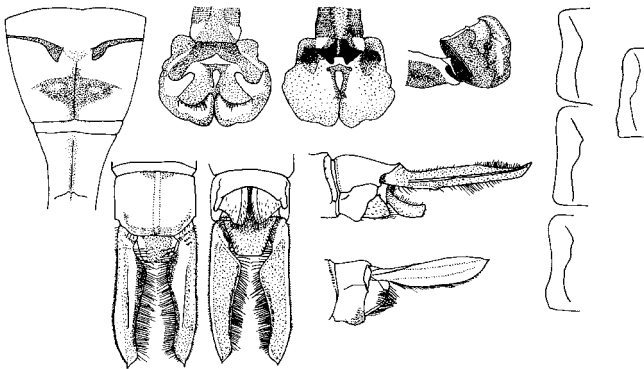


Fig. 3.2.447 *Anax concolor*: second abdominal segment of the male in dorsal view (upper left), apex of the penis in dorsal, ventral, and lateral view (upper middle, left to right), apex of the abdomen of a male in dorsal (lower left), ventral (lower left center), and lateral view (middle right center), apex of the abdomen of a female in lateral view (lower right center), and the lateral and ventral carinas on the one side of the fourth through seventh abdominal segments of a female (right, above to below and far right, respectively). Based on Geijskes (1968).

2. Active during the day. The frons may be uniform in color (**Fig. 3.2.447**). The wings have yellowish spots but are hyaline at the base. Total length including appendages: 67 to 77 mm. Length of abdomen with appendages: 48 to 55 mm. Hind wing length: 41 to 49 mm. Length of hind femur: 11.3 to 14 mm.

.....*Anax concolor* Brauer, 1865
(Mexico, Central America, West Indies, Ecuador, Colombia, Venezuela, French Guiana, Surinam, Bolivia, Argentina, Amazonas, São Paulo, Santa Catarina, Mato Grosso).

- Crepuscular. The face is greenish yellow with a black or brown triangle bordered by yellow on the frons and often a small blue or brownish triangle on each side of it. The color is green with various dark brown or black markings. Total length: 68 to 75 mm. Length of abdomen: 48 to 54 mm. Hind wing length: 46 to 52 mm (**Fig. 3.2.422**).

.....*Anax amazili* (Burmeister, 1839)
(North and Central America, West Indies, Ecuador, Peru, Venezuela, French Guiana, Uruguay, Argentina, Paraguay, São Paulo). Syn: *Aeschna amazili* Burmeister, 1839; *Anax maculatus* Rambur, 1842.

Key to the species of known *Anax* larvae in South America

Information for the key was provided by Geijskes (1968) and Rodrigues Capítulo (1981).

1. The hook at the end of the labial palp of the final larval instar is rounded (**Fig. 3.2.448**). The larvae are normally somewhat greenish, especially when they inhabit vegetation. The median cleft in the prementum is open for a distance of 0.12 to 0.22 mm. Total length of final instar: c. 45 mm.

.....*Anax amazili* (Burmeister, 1839)
(North and Central America, West Indies, Ecuador, Peru, Venezuela, French Guiana, Uruguay, Argentina, Paraguay, São Paulo). Syn: *Aeschna amazili* Burmeister, 1839; *Anax maculatus* Rambur, 1842.

- The hook at the end of the labial palp of the final larval instar is truncate with an acute tip (**Fig. 3.2.449**).2

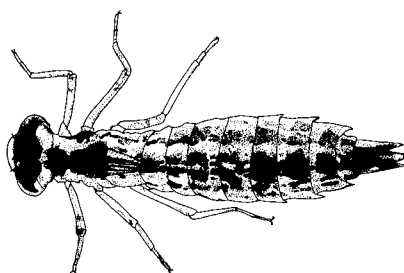


Fig. 3.2.448 Habitus of an *Anax amazili* larva. Based on Rodrigues Capítulo (1981).

2. The median cleft in the prementum forms only a slight indentation along the anterior margin (**Fig. 3.2.437**).

.....*Anax concolor* Brauer, 1865
(Mexico, Central America, West Indies, Ecuador, Colombia, Venezuela, French Guiana, Surinam, Bolivia, Argentina, Amazonas, São Paulo, Santa Catarina, Mato Grosso).

- The median cleft in the prementum forms a deep, V-shaped indentation in the anterior margin (**Fig. 3.2.449**).

.....*Anax longipes* Hagen, 1861
(North America, West Indies, Argentina?, Mato Grosso?).

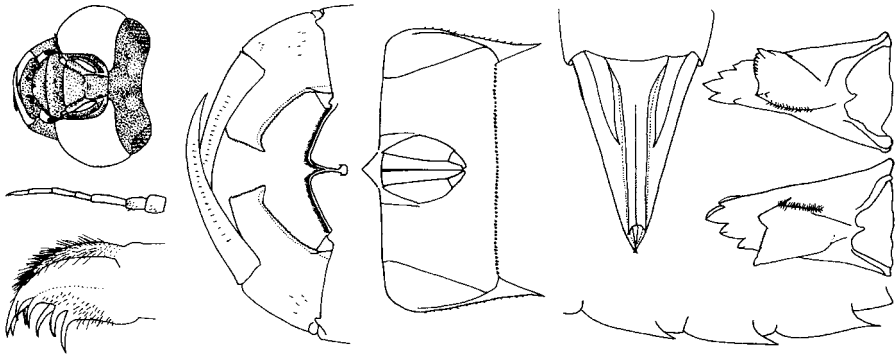


Fig. 3.2.449 *Anax longipes* larva: head in dorsal view (upper left), antenna (middle left), apex of maxilla in ventral view (lower left), anterior part of labium (left center), mandibles (upper right), lateral margin of the seventh through ninth abdominal segments in dorsal view (lower right), ninth segment of a female larva in ventral view (upper center), and the caudal appendages in dorsal view (upper right center). Based on Geijskes (1968).

Key to the species of adult *Allopetalia* in South America

Information for the key was provided by Selys (1873), Ris (1904), Martin (1909), and DeMarmels (2000). Sufficient information to distinguish the larvae, other than on a geographical basis, is not available.

1. The occipital triangle is yellow. There are 13 to 15 antenodal cross veins in the fore-wing (**Fig. 3.2.450**). Length of abdomen: 57 to 58 mm. Hind wing length: 51 to 58 mm. The face is olive, very slightly blackened dorsally.

.....*Allopetalia pustulosa* Selys, 1873
(Colombia, Venezuela).

- The occipital triangle is brown. There are 17 or 18 antenodal cross veins in the fore-wing (**Fig. 3.2.423**). Length of male abdomen: c. 55 mm; female: c. 51 mm. Hind wing length: 47 to 48 mm. The face is grayish yellow, slightly blackened at the edges.

.....*Allopetalia reticulosa* Selys, 1873
(Chile). Syn: *Anax striatus* Kirby, 1899.

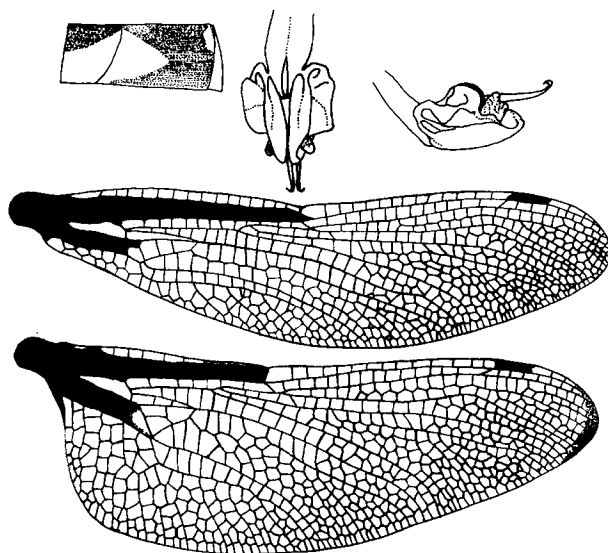


Fig. 3.2.450 *Allopetalia pustulosa* male (above, left to right): fourth abdominal segment in lateral view, apical section of penis in ventral and lateral view, and (below): fore and hind wing. Based on Martin (1909) and DeMarmels (2000).

Key to the species of adult *Limnetron* in South America

Information for the key was provided by Ris (1913c). This key is tentative because some authors recognize only one South American species of *Limnetron*, relegating the name *L. antarcticum* to the status of a junior synonym.

1. The hind wing is about 11.5 mm wide at the nodus. In dorsal view, the superior anal appendage is about 3 to 3.5 times the length of the inferior appendage (**Fig. 3.2.424**). Length of abdomen: c. 43 mm plus an appendage length of about 4.5 mm. Hind wing length: c. 40 mm. Length of pterostigma: c. 2.5 mm. Coloration of the male: head yellowish brown and olive with blackish markings; thorax chocolate brown with greenish markings; abdomen is brightly patterned with reddish brown, greenish, dark brown, and blackish.

.....*Limnetron antarcticum* Foerster, 1907
(Argentina). Syn: probably *Aeshna viridivittatum* Fraser, 1947.

- The hind wing is about 16.5 mm wide at the nodus. In dorsal view, the superior anal appendage is obviously more than 3.5 times the length of the inferior appendage. The penis ends in a long process (**Fig. 3.2.451**).

.....*Limnetron debile* (Karsch, 1891)
(Argentina, Paraguay, Brazil). Syn: *Epiaeschna debile* Karsch, 1891.

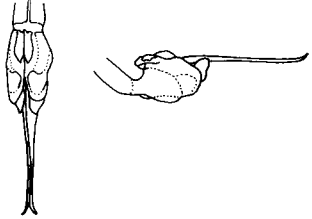


Fig. 3.2.451 Apical section of the penis of *Limnetron debile* in ventral (left) and lateral view (right). Based on DeMarmels (2000).

Key to the species of adult *Andaeschna* in South America

Information for the key was provided by DeMarmels (1994b).

1. The tibiae are black. The dorsal surfaces of the abdominal tergites are bluish or bluish green with black on the carina (**Fig. 3.2.452**).2
- The tibiae are red. The dorsal surfaces of the abdominal tergites are uniform red or dark brown (**Fig. 3.2.453**).3

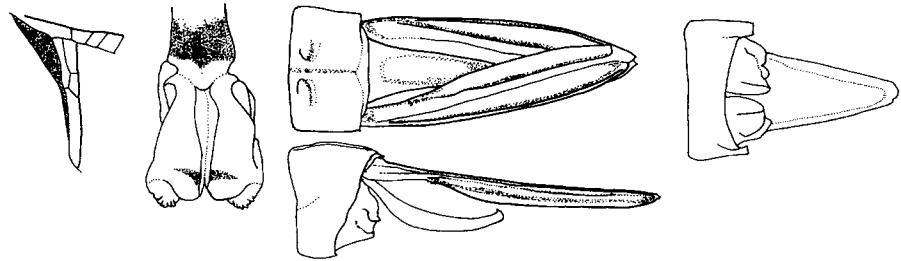


Fig. 3.2.452 *Andaeschna unicolor* male (left to right): anal triangle of the hind wing, penis in ventral view, apex of the abdomen in dorsal (above) and lateral view (below), and inferior anal appendage in ventral view. Based on DeMarmels (1994b).

2. The frons has a broad, dark brown band basally, anterior to the middle ocellus. The thorax is dull green. The pale markings on the abdomen are green. The superior anal appendage of the male is broadly lanceolate. The anal appendages of the female are as long as the ninth and tenth segments together and

have a leaf-like shape with rounded apices (**Fig. 3.2.452**). Length of female abdomen, including appendages: 57 mm. Hind wing length of female: 50 mm. Hind wing width of female: 11 mm.

.....*Andaeschna unicolor* (Martin, 1908)
(Bolivia). Syn: *Aeschna unicolor* Martin, 1908.

- The frons does not have a broad, dark brown basal band anterior to the middle ocellus. The color varies from sky blue to turquoise. The superior anal appendage of the male is narrowly lanceolate. An anal appendage of the female is hardly longer than the ninth segment and acutely pointed at the apex (**Fig. 3.2.425**)

.....*Andaeschna andresi* (Rácenis, 1958)
(Venezuela). Syn: *Aeshna andresi* Rácenis, 1958.

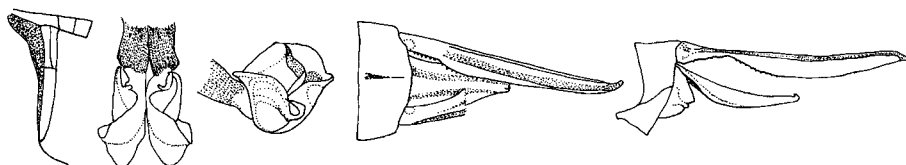


Fig. 3.2.453 *Andaeschna timotocuica* male (left to right): anal triangle of the hind wing, penis in ventral and lateral view, and apex of the abdomen in dorsal view with one of the superior anal appendages broken off, and in lateral view. Based on DeMarmels (1994b).

3. The tarsi are nearly black, and the abdomen of the male is brick red. The inferior anal appendage is much longer than the tenth abdominal segment and almost half as long as the superior appendage (**Fig. 3.2.453**). Total length of male with anal appendages: 66.8 mm. Length of male abdomen: 49.3 mm. Hind wing length of male: 48 mm. Anterior margin of pterostigma: 3.5 mm. The female has not been described.

.....*Andaeschna timotocuica* DeMarmels, 1994
(Venezuela). This species was recommended for consideration as an endangered species in Venezuela (DeMarmels, 1999).

- The tarsi are red. The thorax is rust-red with a uniform faint green shade laterally. The abdomen is dark brown with pale markings, if any, rust-red. The inferior anal appendage is only about as long as the tenth abdominal segment and obviously shorter than half the length of the superior appendage (**Fig. 3.2.454**). Length of abdomen, including appendages: 48 mm. Hind wing length: 52 mm. Hind wing width: 16.5 mm. The male is unknown.

.....*Andaeschna rufipes* (Ris, 1918)
(Peru, Colombia, Venezuela). Syn: *Aeschna rufipes* Ris, 1918.

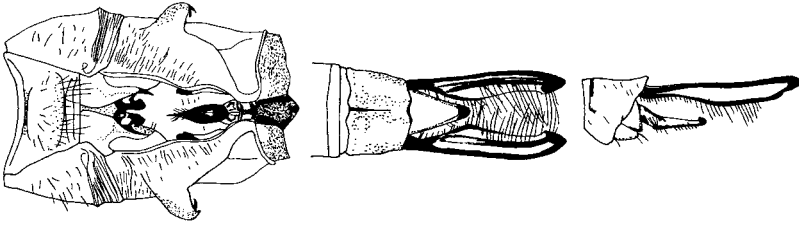


Fig. 3.2.454 *Andaeschna rufipes* male (left to right): genitalia on the second abdominal segment in ventral view and the apex of the abdomen in dorsal and lateral view. Based on DeMarmels (1981c).

Key to the species of known *Andaeschna* larvae in South America

Information for the key was provided by DeMarmels (1994). The larvae of *Andaeschna unicolor* has not been described. The larvae of the three known species are very similar, and they have not been thoroughly described. They are therefore difficult to identify with certainty.

1. The prementum is relatively narrow and long, at c. 8.5 mm. The projections of the caudal pyramid measure about $\frac{2}{5}$ the length of the epiproct, which itself is about $\frac{4}{5}$ the length of a paraproct. Each cercus is $\frac{3}{5}$ as long as a paraproct and $\frac{3}{4}$ as long as the epiproct (**Fig. 3.2.455**). The pale mesepisternal band becomes diffuse or is interrupted near its distal end. The total length reaches about 41 mm.

.....*Andaeschna timotocuica* DeMarmels, 1994 (Venezuela). This species was recommended for consideration as an endangered species in Venezuela (DeMarmels, 1999).

- The prementum is somewhat broader and reaches a length only rarely exceeding 8.25 mm (**Fig. 3.2.456**).2

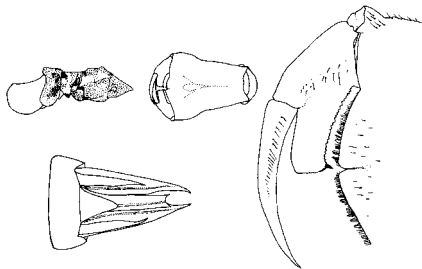


Fig. 3.2.455 *Andaeschna timotocuica* larva: half of the posterior part of the head and anterior part of the thorax in dorsal view (upper left), labium in ventral view (upper center), one labial palp and the anterior part of the prementum in dorsal view (right), and the apex of the abdomen in dorsal view (lower left). Based on DeMarmels (1994b).

2. The entire caudal pyramid appears especially long. Each mesepisternum has a pale longitudinal stripe that is not interrupted over its entire length (**Fig. 3.2.456**).

.....*Andaeschna andresi* (Rácenis, 1958)
(Venezuela). Syn: *Aeshna andresi* Rácenis, 1958.

- The caudal pyramid does not appear especially long (**Fig. 3.2.444**). The stripe on each mesepisternum is incomplete or absent.

.....*Andaeschna rufipes* (Ris, 1918)
(Peru, Colombia, Venezuela). Syn: *Aeshna rufipes* Ris, 1918.

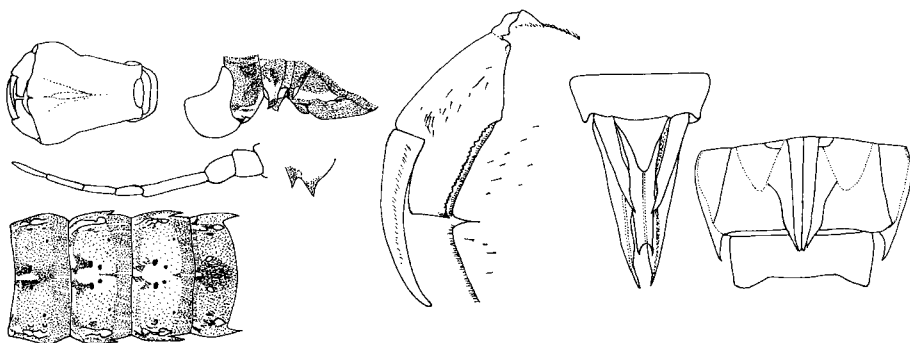


Fig. 3.2.456 *Andaeschna andresi* larva: labium in ventral view (upper left), antenna (middle left), left side of the head and part of the thorax in dorsal view (upper left center), subracoxal processes on the prothorax in dorsal view (lower left center), labial palp and the anterior margin of the mentum (center), caudal appendages in dorsal view (right center), the gonapophyses of a female larva in ventral view (right), and the color pattern on the fifth through eighth abdominal segments of a male larva in dorsal view. Based on DeMarmels (1992c).

Key to the species of adult male *Rhionaeschna* in South America

Information for the key was provided by Calvert (1956), Fraser (1958b), Machado (1985a, b; 1994a), Jurzitza (1990a, b), Muzón and von Ellenrieder, (2001), von Ellenrieder (2000c, 2001a, 2003), and Carvalho and Salgado (2004). According to von Ellenrieder (2003), various misidentifications have been made in the past, and these could lead to errors when using older literature to identify specimens. The subgenera recognized by earlier authors were not accepted by von Ellenrieder (2003). They are nevertheless noted in the key. Unless otherwise stated, the body dimensions are shown as combined ranges for both sexes.

1. In a lateral view of the head, the frons is elevated dorsal to the vertex. There are no pale markings on the seventh through tenth abdominal segments. The synthorax is uniform reddish brown. There is a finger-like projection in the

middle of the anteroventral margin of the hamulus (**Fig. 3.2.426**). Total length: 77 to 82 mm. Hind wing length: 49 to 56 mm. Length of superior anal appendage of male: c. 6.5 mm; female: 2.5 to 2.6 mm.

.....*Rhionaeschna draco* (Rácenis, 1958)
(Venezuela). Syn: *Aeshna draco* Rácenis, 1958.

- In a lateral view of the head, the vertex is dorsal to the frons. There are pale spots on the fourth through eighth abdominal segments and sometimes on the ninth and tenth, as well. There is no finger-like projection in the middle of the anteroventral margin of the hamulus (**Fig. 3.2.457**).2

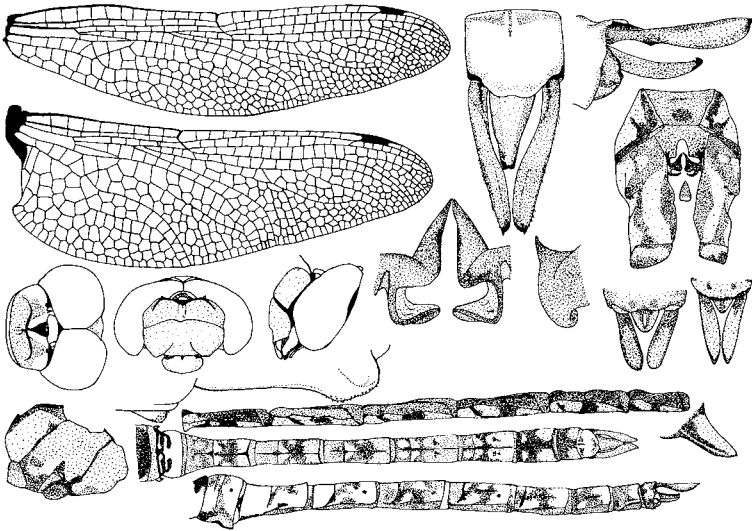


Fig. 3.2.457 *Rhionaeschna brevifrons*: fore and hind wing (upper left); head in dorsal, frontal, and lateral view (middle left, left to right); color pattern on the synthorax of a male in lateral view (lower left), lateral profile of the ventral tubercle on the first and male genitalia of the second abdominal segment (below views of head); ventral view of the first and second abdominal segments of a male (upper middle right); hamular lobes in posterior (center) and lateral view (right of center); color pattern on the abdomen of a male in ventral, dorsal, and lateral view (lower center, top to bottom); apex of the male abdomen in dorsal (upper right center) and lateral view (upper right); apex of the abdomen of two females with different forms of superior appendages (lower middle right); the spine on the anterior lamina (lower right). Based on von Ellenrieder (2003).

2. The synthorax is pale with scattered black lateral markings forming a marbled pattern. The anterior process of the hamule is long with the axis of the hamule farther from its ventral apex than from the dorsal end of its fold. The two rows

of cells between veins M_1 and M_2 usually begin proximal to the pterostigma, beneath its proximal margin or under its proximal half (**Fig. 3.2.457**).

.....subgenus *Marmaraeschna*.....3
 - The synthorax has two pale, oblique lateral stripes that may be broken into a line of spots, or it is of only one color. The anterior process of the hamule is short with the axis of the hamule closer to its ventral apex than to the dorsal end of its fold (**Fig. 3.2.458**).subgenus *Neureclipsa*.....9

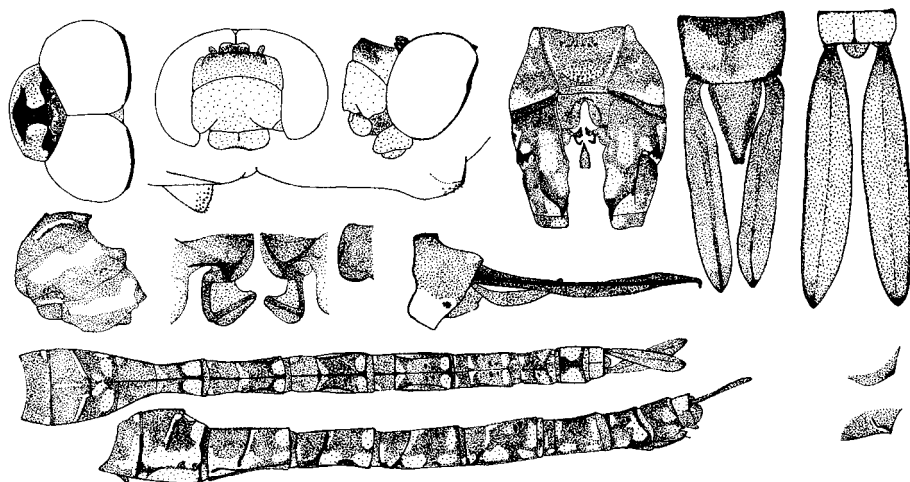


Fig. 3.2.458 *Rhionaeschna psilus*: head in dorsal, frontal, and lateral view (upper left, left to right); color pattern of the synthorax of a male in lateral view (middle left), lateral profile of the ventral tubercle on the first and male genitalia of the second abdominal segment (below views of head); ventral view of the first and second abdominal segments of a male (upper center); hamular lobes in posterior (left center) and lateral views (left center, left and right, respectively); color pattern on the abdomen of a male in dorsal and lateral view (lower left, top and bottom, respectively); apex of the male abdomen in dorsal (upper right center) and lateral view (right center); apex of the female abdomen (upper right); the spine on the anterior lamina of two specimens (lower right). Based on von Ellenrieder (2003).

3. The superior anal appendages are 3.5 to 4.8 mm long. There is only a slight constriction on the third abdominal segment (**Fig. 3.2.457**).4
 - The superior anal appendages are 4.9 to 6.5 mm long. There is considerable constriction of the third abdominal segment (**Fig. 3.2.459**).6
 4. In anterior view, a deep medial depression is evident in the frontal ridge. On the sixth abdominal segment, the inner and outer ventral carina are straight and parallel. There are two or three black spots on the mesepisternum, a total of four

or five on the mesepimeron and metepisternum, and three on the metepimeron. The superior anal appendage has a prominent subbasal tooth (**Fig. 3.2.460**). Total length: 56 to 59 mm. Hind wing length: 13 to 17 mm. Length of superior anal appendage of male: 3.5 to 4.5 mm; female: 1.7 to 2.2 mm.

.....*Rhionaeschna fissifrons* (Muzón and von Ellenrieder, 2001) (Peru, Bolivia, Chile, Argentina). Syn: *Aeshna* (*Marmaraeschna*) *fissifrons* Muzón and von Ellenrieder, 2001. The specimens from Peru referred to as *Rhionaeschna intricata* by Calvert (1956), who provided a supplemental description and illustrations, actually belong to this species (Muzón and von Ellenrieder, 2001).

- The frontal ridge has no more than a slight concavity in the middle (**Fig. 3.2.457**).5

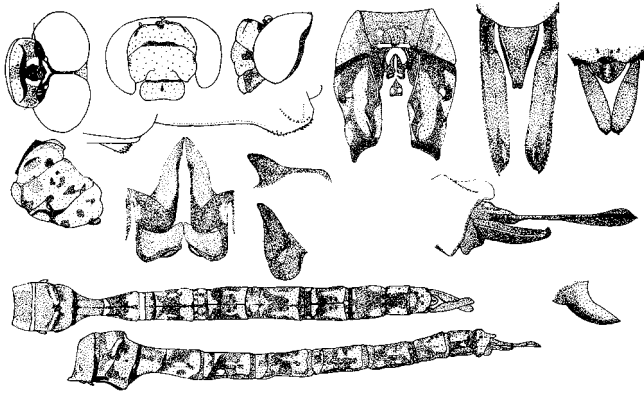


Fig. 3.2.459 *Rhionaeschna brevicercia*: head in dorsal, frontal, and lateral view (upper left, left to right); color pattern of the synthorax of a male in lateral view (upper middle left), lateral profile of the ventral tubercle on the first and male genitalia of the second abdominal segment (below views of head); ventral view of the first and second abdominal segments of a male (upper center); hamular lobes in posterior (left center) and lateral views (center); color pattern on the abdomen of a male in dorsal and lateral view (below, top and bottom, respectively); apex of the male abdomen in dorsal (upper right center) and lateral view (middle right); apex of the female abdomen (upper right); the spine on the anterior lamina (lower right). Based on von Ellenrieder (2003).

5. In anterior view, the frontal ridge appears straight. There are two pale, apical, subdorsal spots on the eighth and ninth segments, which are not extended laterally and not confluent with the posteriolateral pale markings. There are no pale anterior markings on the ninth segment (**Fig. 3.2.461**). Total length: 59 to 60 mm. Hind wing length: 43 to 51 mm. Length of superior anal appendage of male: 4.1 to 4.7 mm; female: 1.8 to 2.2 mm.

.....*Rhionaeschna pallipes* (Fraser, 1947) (Argentina). Syn: *Aeshna* (*Marmoraeschna*) *pallipes* Fraser, 1947.

- In anterior view, the frontal ridge appears slightly concave. On the sixth abdominal segment, the inner and outer ventral carinae are sinuous. There is one black spot on the mesepisternum, a total of three on the mesepimeron and metepisternum, and one on the metepimeron. The superior anal appendage has a low subbasal tooth. The T-spot on the head consists of a longitudinal stripe separated from or narrowly joined to the transverse arms. There is no pale spot on the midline along the posterior borders of the eighth and the ninth segments and no longitudinal carina on the dorsal side of the male superior appendage; instead, it has a swelling on the lower side that reaches its maximum size in the basal 1/4 and then tapers distally. In 90% of the specimens Calvert (1956) examined, there was only one cell on the proximal side of the discoidal triangle on the fore-wing. The discoidal triangle on the hind wing has fewer than four cells (**Fig. 3.2.457**). Total length: 37 to 70 mm. Hind wing length: 41 to 46 mm. Length of superior anal appendage of male: 4.2 to 4.8 mm; female: 1.9 to 2.3 mm.

.....*Rhionaeschna brevifrons* (Hagen, 1861)
(Mexico, Central America, Venezuela, Peru, Chile, Paraguay). Syn: *Aeshna brevifrons* Hagen, 1861; *Aeshna* (*Rhionaeschna*) *maita* Förster, 1909.

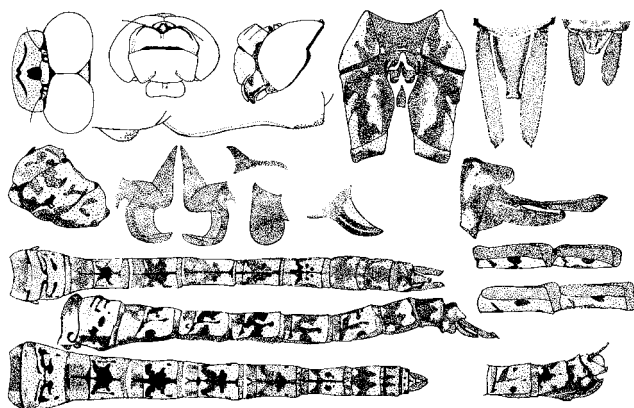


Fig. 3.2.460 *Rhionaeschna fissifrons*: head in dorsal, frontal, and lateral view (upper left, left to right); color pattern of the synthorax of a male in lateral view (upper middle left), lateral profile of the ventral tubercle on the first and second abdominal segments (below views of head); ventral view of the first and second abdominal segments of a male (above, right of center); hamular lobes in posterior and lateral views (left center, left to right); color pattern on the abdomen of a male in dorsal and lateral view and a female in dorsal view (lower left, top to bottom); apex of the male abdomen in dorsal (upper right center) and lateral view (middle right); ventral view of two abdominal segments of a male and a female (lower middle right, top and bottom, respectively); apex of the female abdomen in dorsal (upper right) and lateral view (lower right); spine on the anterior lamina (center). Based on von Ellenrieder (2003).

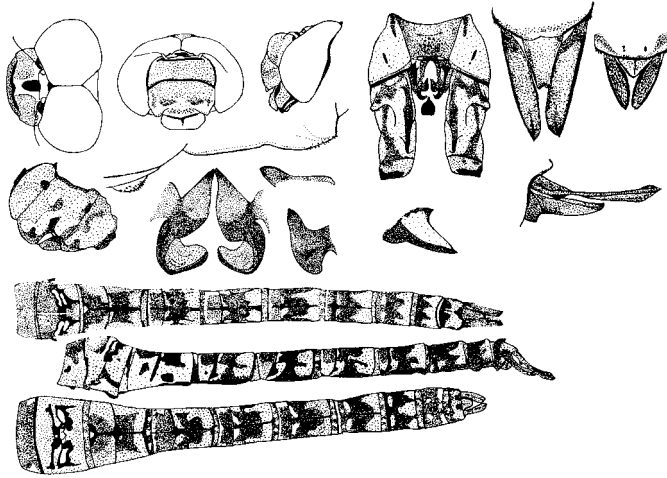


Fig. 3.2.461 *Rhionaeschna pallipes*: head in dorsal, frontal, and lateral view (upper left, left to right); color pattern of the synthorax of a male in lateral view (upper middle left); lateral profile of the ventral tubercle on the first and male genitalia of the second abdominal segment (below views of head); ventral view of the first and second abdominal segments of a male (above, right of center); hamular lobes in posterior (left center) and lateral views (center); color pattern on the abdomen of a male in dorsal and lateral view and of a female in dorsal view (below, top to bottom); apex of the male abdomen in dorsal (upper right center) and lateral view (middle right); apex of the female abdomen (upper right); the spine on the anterior lamina (right of center). Based on von Ellenrieder (2003).

6. The dorsal ridge on the superior anal appendage of the male has a poorly developed sub-basal tooth, and the small process at the apex of this appendage is situated at the outer margin (**Fig. 3.2.459**). The superior anal appendage of the female does not exceed 3 mm in length.7
 - The dorsal ridge on the superior anal appendage of the male has a well-developed sub-basal tooth, and the small process at the apex of this appendage is situated near the middle (**Fig. 3.2.462**). The superior anal appendage of the female is at least 3.7 mm in length.8
 7. The T-spot on the head consists of a longitudinal stripe joined broadly to its transverse extensions. The ventral tubercle on the first abdominal segment is more than three times as long as high (**Fig. 3.2.459**). Total length: 66 to 74 mm. Hind wing length: 48 to 52 mm. Length of superior anal appendage of male: 5.4 to 6.0 mm; female: 2.7 to 3.0 mm.

.....*Rhionaeschna brevicercia* (Muzón and von Ellenrieder, 2001) (Colombia, Ecuador, Venezuela). Syn: *Aeshna* (*Marmaraeschna*) *brevicercia* Muzón and von Ellenrieder, 2001.

- The basal stem of the T-spot is narrow where it joins the cross bar. The ventral tubercle on the first abdominal segment is roughly twice as long as high (Fig. 3.2.463). Total length: 66 to 68 mm. Hind wing length: 46 to 51 mm. Length of superior anal appendage of male: 4.9 to 5.5 mm; female: c. 3.7 mm.

..... *Rhionaeschna intricata* (Martin, 1908) (Mexico through Colombia, Ecuador, Peru, and Venezuela to Argentina and Chile and throughout Brazil). Syn: *Aeshna* (*Marmoraeschna*) *intricata* Martin, 1908. According to Muzón and von Ellenrieder, (2001), the specimens from Peru described and illustrated under the name of *Aeshna intricata* by Calvert (1956) actually belong to the species *Rhionaeschna fissifrons*.

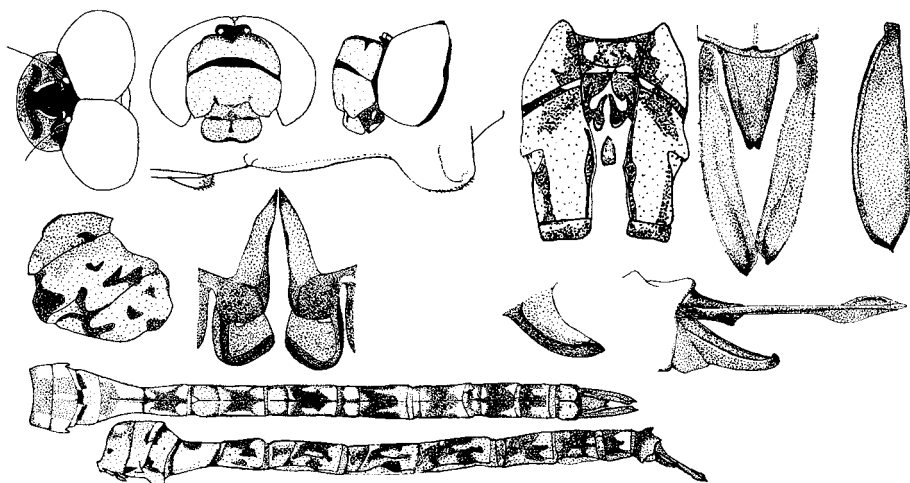


Fig. 3.2.462 *Rhionaeschna obscura*: head in dorsal, frontal, and lateral view (upper left, left to right); color pattern of the synthorax of a male in lateral view (upper middle left), lateral profile of the ventral tubercle on the first and male genitalia of the second abdominal segment (below views of head); ventral view of the first and second abdominal segments of a male (above, right of center); hamular lobes in posterior view (left center); color pattern on the abdomen of a male dorsal and lateral view (below, top and bottom, respectively); apex of the male abdomen in dorsal (upper right center) and lateral view (middle right); superior anal appendage of a female (upper right); the spine on the anterior lamina (right center). Based on von Ellenrieder (2003).

8. The T-spot on the head consists of a longitudinal stripe joined broadly to its transverse extensions. The widest point of the superior anal appendage of the

female is distal of its midlength and equals about $\frac{1}{4}$ of its length (**Fig. 3.2.462**). Total length: 72 to 81 mm. Hind wing length: 47 to 54 mm. Length of superior anal appendage of male: 5.8 to 6.5 mm; female: 5.6 to 6.0 mm.

.....*Rhionaeschna obscura* (Muzón and von Ellenrieder, 2001) (Chile, Peru, Bolivia). Syn: *Aeshna* (*Marmaraeschna*) *obscura* Muzón and von Ellenrieder, 2001.

- The T-spot on the head consists of a longitudinal stripe joined very narrowly to its cross bar. The vertex of the head is yellow on its anterior 70% (**Fig. 3.2.464**). The sub-basal tooth on the superior anal appendage of the male forms a right angle, and the dorsal ridge on that appendage covers about $\frac{3}{10}$ of its length. The length of the superior anal appendage of the male is 5.8 to 6.5 mm, and that of the female is 4.9 to 5.7 mm. There is an arched longitudinal carina on the apical $\frac{1}{4}$ to $\frac{1}{3}$ of the dorsal side of the male superior appendage. A tubercle located $\frac{1}{4}$ of the way from the base of the lower side on this appendage has a distinctly angular posterior margin. In all specimens examined by Calvert (1956), there were two cells on the proximal side of the discoidal triangle of the fore and hind wings. In 83% of the specimens examined by Calvert (1956), there were four cells in the discoidal triangle of the hind wing. Total length: 72 to 77 mm. Hind wing length: 47 to 55 mm. Length of superior anal appendage of male: 5.8 to 6.4 mm; female: 4.9 to 5.7 mm.

.....*Rhionaeschna vigintipunctata* (Ris, 1918) (Venezuela, Peru, Bolivia, Argentina). Syn: *Aeshna* (*Marmoraeschna*) *vigintipunctata* Ris, 1918; *Aeschna laticeps* Hagen, 1875 (nomen nudum). Schmidt (1942) considered this name a synonym of *Rhionaeschna brevifrons*.

9. On the ventral surfaces of the ninth and tenth abdominal segments, there are light blue markings posterior to the genital opercula. There is no subbasal tooth on the superior anal appendage, which curves sharply ventrad at the apex (**Fig. 3.2.458**).10

- The ventral surfaces of the ninth and tenth abdominal segments are yellow, pale brown, dark brown, or black. The superior anal appendage has a basal tooth, or it does not curve sharply ventrad at the apex, or both (**Fig. 3.2.465**).15

10. In lateral view, the dorsal crest of the superior anal appendage appears angulate and lower than the base of the appendage (**Fig. 3.2.458**). The mesepimeral and metepimeral stripes are not or are only slightly constricted on their anterior margins, and the anterior lamina of the male has only rudimentary stripes 0.09 to 0.14 mm long. Total length: 59 to 62 mm. Hind wing length: 36 to 44 mm. Length of superior anal appendage of male: 4.9 to 5.9 mm; female: 7.2 to 8.3 mm.

.....*Rhionaeschna psilus* (Calvert, 1947) (North and Central America, West Indies, Ecuador, Peru, Venezuela, Argentina). Syn: *Aeshna confusa* Rambur, 1842; probably *Aeshna dominicana* Hagen, 1861 (nomen nudum).

- The superior anal appendage has a dorsal crest that appears smoothly curved in lateral view and rises above the base of the appendage (**Fig. 3.2.466**).11

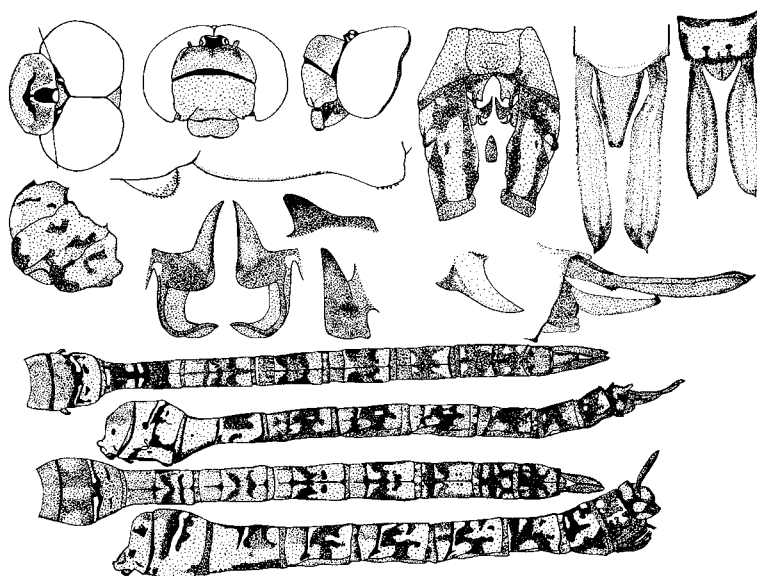


Fig. 3.2.463 *Rhionaeschna intricata*: head in dorsal, frontal, and lateral view (upper left, left to right); color pattern of the male synthorax in lateral view (upper middle left); lateral profile of the ventral tubercle on the first and male genitalia of the second abdominal segment (below views of head); ventral view of the first and second abdominal segments of a male (above, right of center); hamular lobes in posterior (left center) and lateral views (center); color pattern on the abdomen of a male and a female in dorsal and lateral view (below, top and bottom, respectively); apex of the male abdomen in dorsal (upper right center) and lateral view (middle right); apex of the female abdomen (upper right); the spine on the anterior lamina (right center). Based on von Ellenrieder (2003).

11. There are wide and shallow indentations or no indentations at all in the pale mesepimeral and metepimeral stripes on the synthorax (**Fig. 3.2.466**).12
 - There are deep, semi-circular indentations in the pale mesepimeral and metepimeral stripes on the synthorax (**Fig. 3.2.467**).13
 12. At midlength, the pale mesepimeral stripe is only about half as wide as at its widest point. The anterior margin of the ventral tubercle on the first abdominal segment is concave. The dorsal crest on the superior anal appendage ascends gradually at the base (**Fig. 3.2.466**). Total length: 63 to 72 mm. Hind wing length: 42 to 45 mm. Length of superior anal appendage of male: 5.0 to 5.5 mm; female: 3.0 to 3.8 mm.

.....*Rhionaeschna nubigena* (DeMarmels, 1989)
 (Venezuela). Syn: *Aeshna nubigena* DeMarmels, 1989.

- The pale mesepimeral stripe is approximately the same width for its entire length. The anterior margin of the ventral tubercle on the first abdominal segment is convex. The dorsal crest on the superior anal appendage ascends abruptly at the base (**Fig. 3.2.468**). Total length: 58 to 67 mm. Hind wing length: 39 to 46 mm. Length of superior anal appendage of male: 5.0 to 5.9 mm; female: 3.4 to 6.5 mm.

.....*Rhionaeschna cornigera* (Brauer, 1865)
(Mexico, Central America, Colombia, Venezuela, Ecuador Peru, Bolivia). Syn:
Aeshna cornigera Brauer, 1865.

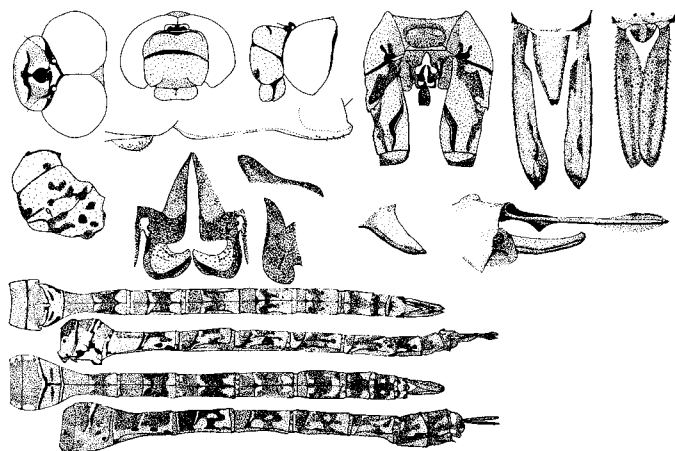


Fig. 3.2.464 *Rhionaeschna vigintipunctata*: head in dorsal, frontal, and lateral view (upper left, left to right); color pattern of the synthorax of a male in lateral view (upper middle left), lateral profile of the ventral tubercle on the first and second abdominal segments (below views of head); ventral view of the first and second abdominal segments of a male (above, right of center); hamular lobes in posterior and lateral views (left center, left and right); color pattern in dorsal and lateral view on the abdomen of a male and a female (below, top to bottom); apex of the male abdomen in dorsal (upper right center) and lateral view (middle right); apex of the female abdomen in dorsal view (upper right); spine on the anterior lamina (center). Based on von Ellenrieder (2003).

13. In lateral view, the ventral tubercle on the first abdominal segment is more than three times as long as high. The apex of the superior anal appendage is directed posteriad; the margins on its apical 3/5 are parallel (**Fig. 3.2.467**). Total length: 63 to 77 mm. Hind wing length: 44 to 53 mm. Length of superior anal appendage of male: 5.7 to 6.0 mm; female: 5.0 to 6.2 mm.

.....*Rhionaeschna pauloi* (Machado, 1994)
(Paraguay, Paraná, Minas Gerais). Syn: *Aeshna pauloi* Machado, 1994.

- In lateral view, the ventral tubercle on the first abdominal segment is only about twice as long as high (**Fig. 3.2.469**).14

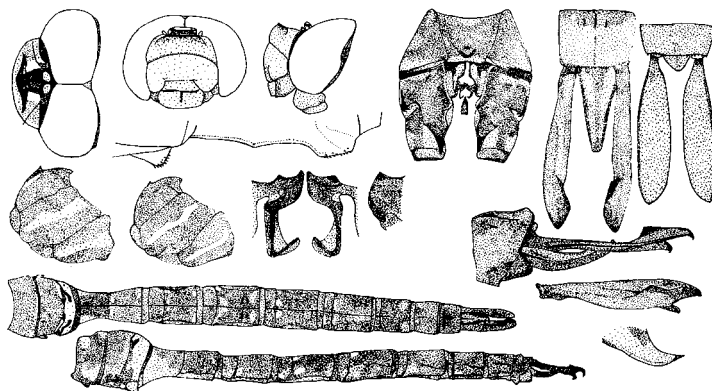


Fig. 3.2.465 *Rhionaeschna jalapensis*: head in dorsal, frontal, and lateral view (upper left, left to right); color pattern on the synthoraces of two different males in lateral view (upper middle left), lateral profile of the ventral tubercle on the first and male genitalia on the second abdominal segment (below views of head); ventral view of the first and second abdominal segments of a male (upper center); hamular lobes in posterior (left center) and lateral view (center); color pattern on the abdomen of a male in dorsal and lateral view (below, top and bottom, respectively); apex of the male abdomen in dorsal (upper right center) and lateral view (middle right); view of the inner side of the superior anal appendage of a male (lower middle right); apex of the female abdomen (upper right); spine on anterior lamina (lower right). Based on von Ellenrieder (2003).

14. The basal bar of the T-spot narrows gradually distally. The pale mesepimeral stripes are about half as wide as the mesanepisternum and not interrupted (**Fig. 3.2.469**). Total length: 57 to 65 mm. Hind wing length: 36 to 44 mm. Length of superior anal appendage of male: 4.1 to 5.4 mm; female: 3.9 to 5.1 mm.

.....*Rhionaeschna planaltica* (Calvert, 1952)
(Colombia, Venezuela, Ecuador Peru, Bolivia, Uruguay Paraguay, Argentina, Mato Grosso, Mato Grosso do Sul, Paraná, Minas Gerais, Espírito Santo, São Paulo, Rio de Janeiro, Santa Catarina, Rio Grande do Sul). Syn: *Aeshna cornigera planaltica* Calvert 1952.

- The basal bar of the T-spot narrows abruptly. The pale mesepimeral stripes are from 1/4 to nearly 1/3 of the width of the mesanepisternum (**Fig. 3.2.470**). Total length: 57 to 59 mm. Hind wing length: 36 to 42 mm. Length of superior anal appendage of male: 4.2 to 5.0 mm; female: 3.1 to 3.5 mm.

.....*Rhionaeschna haarupi* (Ris, 1908)
(Argentina). Syn: *Aeshna (Hesperaeschna) haarupi* Ris, 1908.

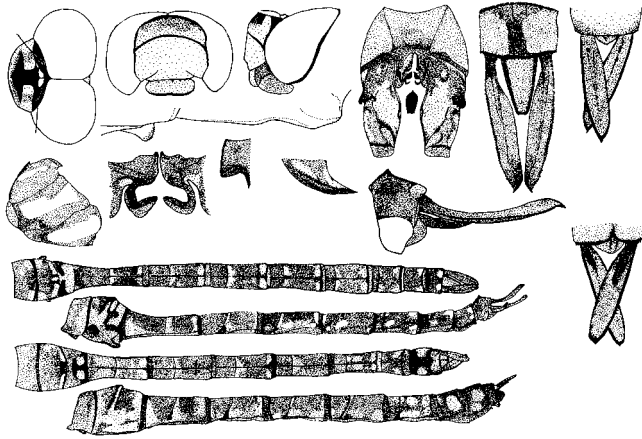


Fig. 3.2.466 *Rhionaeschna nubigena*: head in dorsal, frontal, and lateral view (upper left, left to right); color pattern on the synthorax of a male in lateral view (upper middle left), lateral profile of the ventral tubercle on the first and male genitalia on the second abdominal segment (below views of head); ventral view of the first and second abdominal segments of a male (upper center); hamular lobes in posterior and lateral views (left center, left and right, respectively); color pattern on the abdomen of a male (lower middle left, top and bottom, respectively) and a female in dorsal and lateral view (lower left, top and bottom, respectively); apex of the male abdomen in dorsal (upper right center) and lateral view (middle right); apex of the female abdomen from two different specimens in dorsal view (upper and lower right); spine on anterior lamina (center). Based on von Ellenrieder (2003).

15. There is a ventral process directed posteriad and arising from the inner margin of the apical 1/4 of the superior anal appendage, which has a dorsal crest that appears triangular when viewed laterally; here is also a low, blunt subbasal tooth on this appendage (**Fig. 3.2.465**). There are two rows of cells between veins M_1 and M_2 of both sexes, beginning posterior to the distal part or distal end of the pterostigma. Total length: 67 to 72 mm. Hind wing length: 42 to 46 mm. Length of superior anal appendage of male: 5.7 to 6.2 mm; female: 5.3 to 5.9 mm.

..... *Rhionaeschna jalapensis* (Williamson, 1908) (Mexico, Central America, possibly Venezuela). Syn: *Aeshna* (*Schitzuraeschna*) *jalapensis* Williamson, 1908. Three North American species share some of the characteristics of this species, which is known from Central America but has not yet been confirmed to occur in South America.

- There is no ventral process on the inner margin of the superior anal appendage (**Fig. 3.2.471**).16

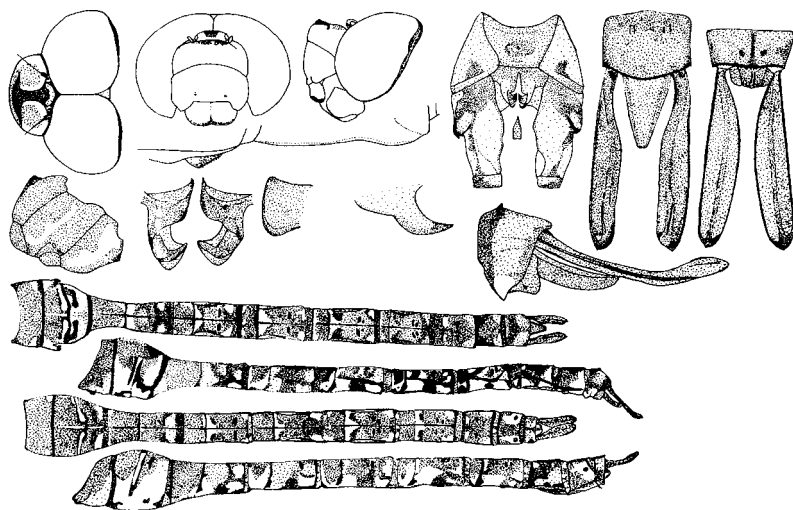


Fig. 3.2.467 *Rhionaeschna pauloi*: head in dorsal, frontal, and lateral view (upper left, left to right); color pattern on the synthorax of a male in lateral view (upper middle left), lateral profile of the ventral tubercle on the first and male genitalia on the second abdominal segment (below views of head); ventral view of the first and second abdominal segments of a male (upper center); hamular lobes in posterior and lateral views (left center, left and right, respectively); color pattern on the abdomen of a male (lower middle left, top and bottom, respectively) and a female in dorsal and lateral view (lower left, top and bottom, respectively); apex of the male abdomen in dorsal (upper right center) and lateral view (middle right); apex of the female abdomen in dorsal view (upper right); spine on anterior lamina (center). Based on von Ellenrieder (2003).

16. The superior anal appendage lacks a sub-basal tooth, and in lateral view, its apex appears to bend sharply ventrad; in dorsal view, it appears to widen toward the apex so that the widest part of the appendage is located between 84% and 88% of distance from the base to the apex. The genital lobe is covered by many small denticles distributed over its lateral and ventral surfaces (**Fig. 3.2.471**).

.....17
 - The superior anal appendage bears a sub-basal tooth, although it may be vestigial, and it does not appear to curve ventrad in lateral view. Only the ventral surface of the genital lobe bears denticles (**Fig. 3.2.472**).25

17. The frontoclypeal groove on the head is covered by a black stripe, which greatly widens as it approaches the eyes. The pale stripes on the synthorax are straight, not interrupted, and occupy less than half the width of the sclerites they cover. The genital lobe on the second abdominal segment is less than $3 \frac{1}{3}$ times as long as its height (**Fig. 3.2.471**).18

- If there is a black stripe covering the frontoclypeal groove, it does not greatly widen near the eyes. The pale stripes on the synthorax is deeply indented or broken into spots, or they occupy more than half the width of the sclerites they cover. The genital lobe on the second abdominal segment is more than $3 \frac{1}{3}$ times as long as its height (**Fig. 3.2.473**).

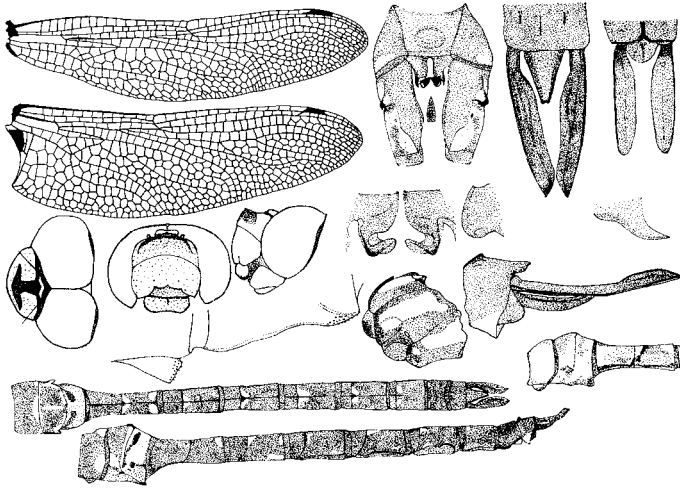


Fig. 3.2.468 *Rhionaeschna cornigera*: fore and hind wing (upper left); head in dorsal, frontal, and lateral view (middle left, left to right); color pattern of the synthorax of a male in lateral view (lower center above abdomen), lateral profile of the ventral tubercle on the first and male genitalia on the second abdominal segment (below views of head); ventral view of the first and second abdominal segments of a male (upper center); hamular lobes in posterior (center) and lateral view (right of center); color pattern on the abdomen of a male in dorsal and lateral view (lower left, above and below, respectively); apex of a male abdomen in dorsal (upper right center) and lateral view (lower middle right); dorsal view of the apex of a female abdomen (upper right); the spine on the anterior lamina (upper middle right). Based on von Ellenrieder (2003).

18. The femora and tibiae are reddish brown, and the veins in the basal quarter or more of the wings are reddish. The posterodorsal and posterolateral spots on the abdominal segments are separate (**Fig. 3.2.474**). The hind wings are longer than 50 mm, and the abdomen is longer than 57 mm.19

- The tibiae are brown or black and darker than the femora. All wing veins are black or brown. The posterodorsal and posterolateral spots on the second abdominal segment and sometimes others are confluent (**Fig. 3.2.471**). The color of the labrum, clypeus, and frons is yellow or light blue. The hind wings are shorter than 50 mm, and the abdomen is shorter than 55 mm.20

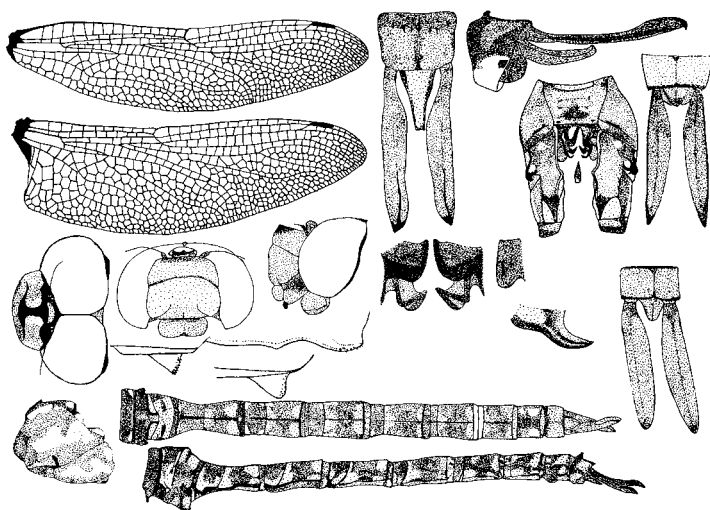


Fig. 3.2.469 *Rhionaeschna planaltica*: fore and hind wing (upper left); head in dorsal, frontal, and lateral view (middle left, left to right); color pattern of the synthorax of a male in lateral view (lower left); lateral profile of the ventral tubercle on the first and male genitalia on the second abdominal segment with a tubercle with a slightly different shape just below it (below views of head); ventral view of the first and second abdominal segments of a male (upper middle right center); hamular lobes in posterior (center) and lateral view (right of center); color pattern on the abdomen of a male in dorsal and lateral view (lower center, above and below, respectively); apex of a male abdomen in dorsal (upper center) and lateral view (upper right); dorsal views of the apices of the abdomens of two female specimens with superior anal appendages of slightly different shapes (upper and lower middle right); the spine on the anterior lamina (lower middle right center). Based on von Ellenrieder (2003).

19. There is no spine on the anterior lamina (**Fig. 3.2.475**). There are 20 antenodal cross veins in the fore-wing and 14 in the hind wing. The color of the labrum, clypeus, and frons is chrome orange. Total length of male: c. 78 mm. Length of abdomen without anal appendages: 59 mm. Length of superior anal appendage: 5.7 to 5.8 mm. Hind wing length: 51 mm. Length of the pterostigma on the fore-wing: 2.9 to 3.0 mm. Coloration of male: pronotum chrome orange with black dots; synthorax burnt sienna with green stripes; abdomen reddish brown except for the chrome orange tenth segment and some pale green or pale blue markings. The pterostigma is brown ochre, and the anterior wing veins have a reddish yellow tinge. The female has not been described.

.....*Rhionaeschna decessus* (Calvert, 1953)
(Rio de Janeiro). Syn: *Aeshna* (*Hesperaeschna*) *decessus* Calvert, 1953.

- There is a spine on the anterior lamina (**Fig. 3.2.474**). There are no more than 18 antenodal cross veins in the fore-wing and 13 in the hind wing. The color of the labrum, clypeus, and frons is yellowish brown or orange with bluish reflections, mainly on the lateral parts. Total length of male: c. 83.5 mm. Length of superior anal appendage: 5.7 to 6.2 mm. Hind wing length: 50 to 51 mm. Length of the pterostigma on the fore-wing: 3.1 to 3.7 mm. Coloration of male: pronotum reddish brown; synthorax reddish brown with narrow stripes that are blue dorsally and cream ventrally and bordered by darker brown than the rest of the synthorax; abdomen reddish brown with black carinae. The pterostigma is brown, and the membranula is black. The female has not been described.

.....*Rhionaeschna serrana* (Carvalho and Salgado, 2004) *comb. nov.* (Rio de Janeiro). Syn: *Aeshna serrana* Carvalho and Salgado, 2004.

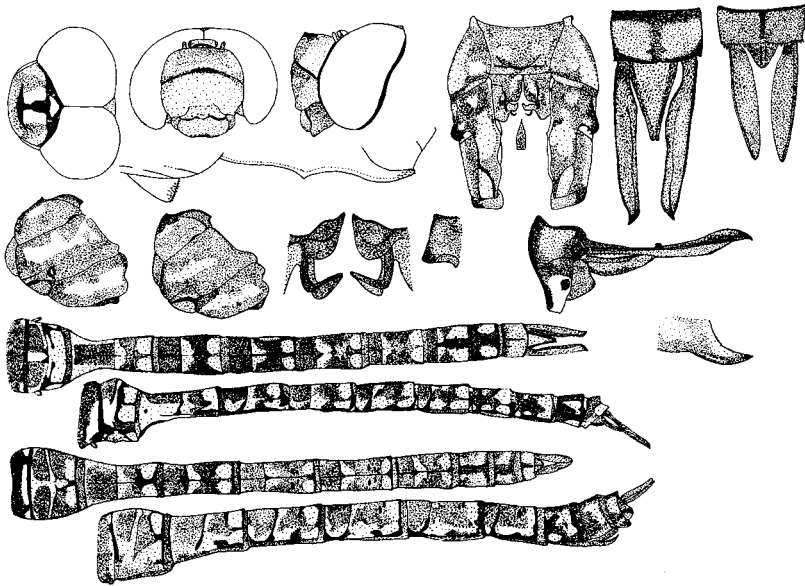


Fig. 3.2.470 *Rhionaeschna haarupi*: head in dorsal, frontal, and lateral view (upper left, left to right); color pattern on the synthorax of two males in lateral view (upper middle left), lateral profile of the ventral tubercle on the first and male genitalia on the second abdominal segment (below views of head); ventral view of the first and second abdominal segments of a male (above, right of center); hamular lobes in posterior and lateral views (center, left and right, respectively); color pattern on the abdomen of a male (lower middle left, top and bottom, respectively) and a female in dorsal and lateral view (lower left, top and bottom, respectively); apex of the male abdomen in dorsal (upper right center) and lateral view (upper middle right); apex of the female abdomen in dorsal view (upper right); spine on anterior lamina (lower middle right). Based on von Ellenrieder (2003).

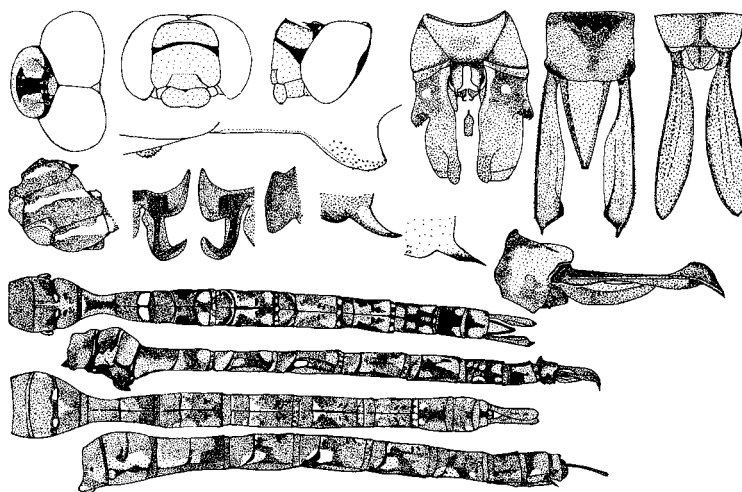


Fig. 3.2.471 *Rhionaeschna punctata*: head of a male in dorsal, frontal, and lateral view (upper left, left to right); color pattern on the synthorax of a male in lateral view (middle left), lateral profile of the ventral tubercle on the first and second abdominal segments (below views of head); ventral view of the first and second abdominal segments of a male (upper center); hamular lobes in posterior and lateral view (left center, left and right, respectively); color pattern on the abdomen of a male and a female in dorsal and lateral view (lower center, top to bottom); apex of the male abdomen in dorsal (upper right center) and lateral view (middle right); apex of the abdomen of a female (upper right); the spines on the anterior lamina of two specimens (center). Based on von Ellenrieder (2003).

20. Hind wing length: at least 50 mm. Length of abdomen, not counting the anal appendages: at least 54 mm. The pale anterolateral spots on the second abdominal segment do not reach the auricles. The pale mid-dorsal spots are not confluent with either the mid-lateral or the posterior dorsal spots. On the ventral side of the first abdominal segment, the tubercle appears smoothly curved and low in lateral view. The black T-spot does not extend to the antefrons. The lateral margins of the vertex are narrowly black, and the central part is yellow (**Fig. 3.2.471**). Total length: 68 to 82 mm. Length of superior anal appendage of male: 5.7 to 6.1 mm; female: c. 5.5 mm.

.....*Rhionaeschna punctata* (Martin, 1908)
 (Mexico?, São Paulo, Minas Gerais, Espírito Santo, Rio de Janeiro, Santa Catarina, Rio Grande do Sul). Syn: *Aeshna* (*Hesperaeshna*) *punctata* Martin, 1908; *Aeshna depravata* Hagen, 1861 (*nomen nudum*); *Aeshna lobata* Hagen, 1861 (*nomen nudum*).

- Hind wing length: less than 48 mm. Length of abdomen, not counting the anal appendages: less than 52 mm. The pale anterolateral spots on the second abdominal segment reach the auricles. The pale mid-dorsal spots are confluent with the mid-lateral spots and also with the posterior dorsal spots on the second abdominal segment (**Fig. 3.2.476**).21

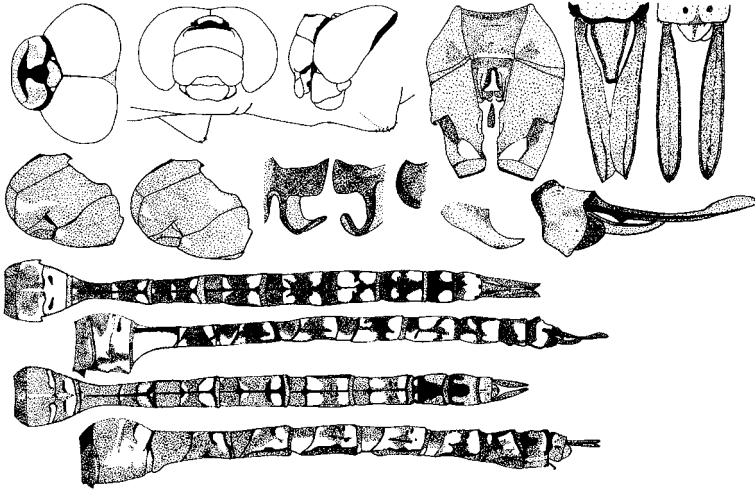


Fig. 3.2.472 *Rhionaeschna elsia*: head in dorsal, frontal, and lateral view (upper left, left to right); color pattern on the synthoraces of two males in lateral view (upper middle left), lateral profile of the ventral tubercle on the first and male genitalia of the second abdominal segment (below views of head); ventral view of the first and second abdominal segments of a male (above, third from right); hamular lobes in posterior (left center) and lateral view (center); color pattern on the abdomen of a male (lower middle left, top to bottom, respectively) and a female in dorsal and lateral view (lower left, top to bottom, respectively); apex of the male abdomen in dorsal (upper right center) and lateral view (middle right); apex of the female abdomen (upper right); the spine on the anterior lamina (right center, right of hamular lobe). Based on von Ellenrieder (2003).

21. The apex of the superior anal appendage is blunter than the dorsal spine on the tenth abdominal segment. Pale anterodorsal spots are absent. The pale median dorsal spots are confluent only on the second abdominal segment. The pale median lateral and posterolateral pairs of spots are not confluent on the eighth abdominal segment. The pale median lateral spots are elongated ventrally only on the eighth abdominal segment (**Fig. 3.2.476**).

.....*Rhionaeschna itatiaia* (Carvalho and Salgado, 2004) *comb. nov.* (Minas Gerais, Rio de Janeiro). Syn: *Aeshna itatiaia* Carvalho and Salgado, 2004. From the description, the validity of this species seems doubtful.

- The apex of the superior anal appendage is more acute than the dorsal spine on the tenth abdominal segment. Pale anterodorsal spots are present on the second through seventh abdominal appendages. The pale median dorsal spots are confluent on the second through seventh abdominal segments. The pale median lateral and posterolateral pairs of spots are confluent on the eighth abdominal segment. The pale median lateral spots are elongated ventrally on the fourth through eighth abdominal segments. On the ventral side of the first abdominal segment, the tubercle appears as a high trapezoid in lateral view. The black T-spot extends to the dorsal surface of the antefrons. The lateral margins and posterior margins of the vertex are black, and the central part is yellow (**Fig. 3.2.477**). Total length: 68 to 72 mm. Hind wing length: 44 to 48 mm. Length of superior anal appendage of male: 5.7 to 6.1 mm; female: 6.3 to 6.7 mm.

.....*Rhionaeschna eduardoi* (Machado, 1985)
(Minas Gerais). Syn: *Aeshna eduardoi* Machado, 1985.

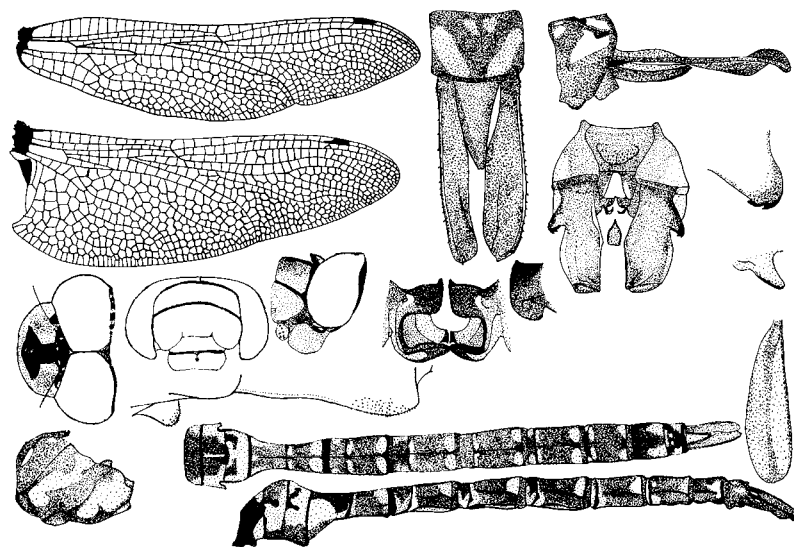


Fig. 3.2.473 *Rhionaeschna demarmelsi*: fore and hind wing (upper left); head in dorsal, frontal, and lateral view (lower middle left, left to right); color pattern of the synthorax of a male in lateral view (lower left), lateral profile of the ventral tubercle on the first and male genitalia on the second abdominal segment (below views of head); ventral view of the first and second abdominal segments of a male (above and right from center) with a toothed lateral process enlarged (upper middle right); hamular lobes in posterior (center) and lateral view (right of center); color pattern on the abdomen of a male in dorsal and lateral view (lower center, above and below, respectively); apex of a male abdomen in dorsal (upper center) and lateral view (upper right); superior anal appendage of a female (lower right); the spine on the anterior lamina (middle right). Based on von Ellenrieder (2003).

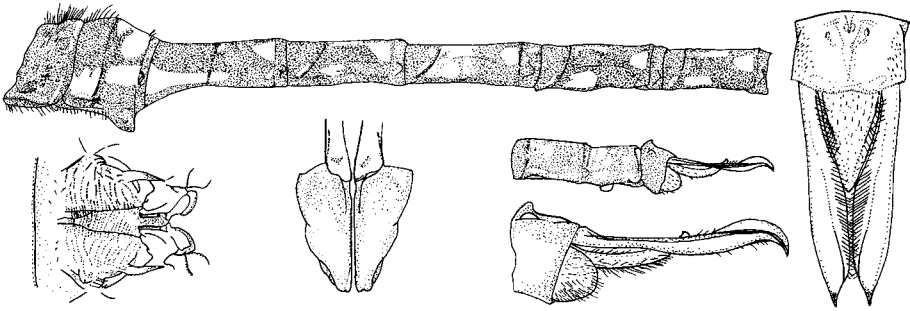


Fig. 3.2.474 *Rhionaeschna serrana* male (above, left to right): first seven abdominal segments in lateral view (above left), three apical abdominal segments and anal appendages in lateral view (right of center), tenth segment and appendages in dorsal (right) and lateral view (lower right center), hamules and anterior lamina of the genitalia on the second abdominal segment in ventral view (lower left), and apical segment of the penis in dorsal view (lower left center). Based on Carvalho and Salgado (2004).

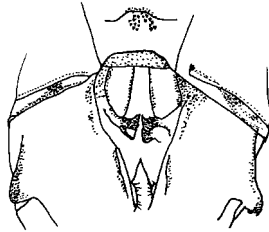


Fig. 3.2.475 The male genitalia on the second abdominal segment of *Rhionaeschna decessus* in ventral view. Based on Calvert (1956).

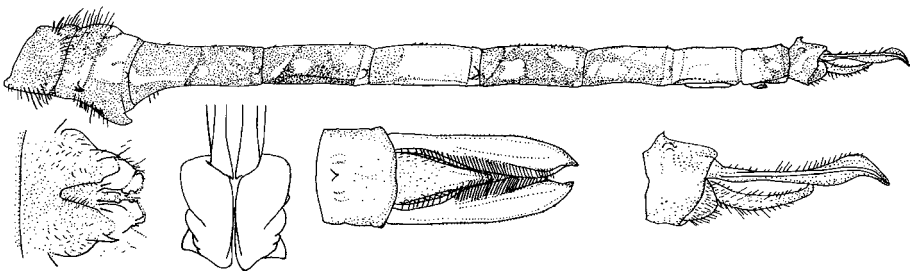


Fig. 3.2.476 *Rhionaeschna itatiaia* male (above, left to right): abdomen in lateral view (above), and (below, left to right): hamules and anterior lamina of the genitalia on the second segment of the abdomen in ventral view, apical segment of the penis in dorsal view, apex of the abdomen in dorsal and lateral view. Based on Carvalho and Salgado (2004).

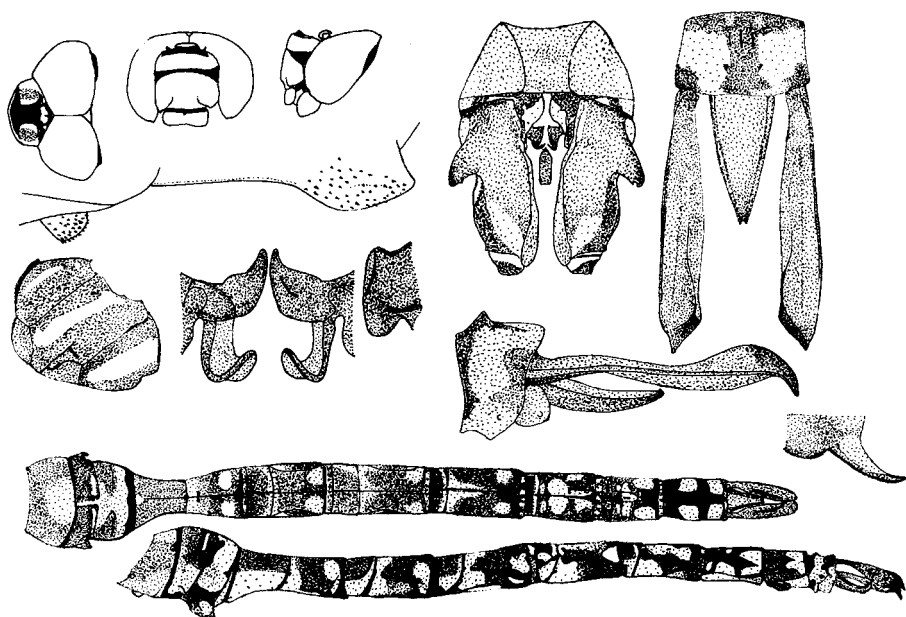


Fig. 3.2.477 *Rhionaeschna eduardoi*: head in dorsal, frontal, and lateral view (upper left, left to right); color pattern on the synthorax of a male in lateral view (middle left), lateral profile of the ventral tubercle on the first and male genitalia of the second abdominal segment (below views of head); ventral view of the first and second abdominal segments of a male (upper center); hamular lobes in posterior (left center) and lateral view (center); color pattern on the abdomen of a male in dorsal and lateral view (below, top to bottom, respectively); apex of the male abdomen in dorsal (upper right) and lateral view (middle right); the spine on the anterior lamina (lower middle right). Based on von Ellenrieder (2003).

22. In lateral view, the superior anal appendage has a smoothly convex dorsal crest near the apex. The basal width of the spine on the anterior lamina is $3 \frac{1}{3}$ times the height of the spine. The hamular field is longer than the ventral portion of the hamulus (**Fig. 3.2.473**). Total length: 58 to 68 mm. Hind wing length: 40 to 44 mm. Length of superior anal appendage of male: 5.0 to 5.3 mm; female: 5.0 to 5.9 mm.

.....*Rhionaeschna demarmelsi* von Ellenrieder, 2003 (Venezuela).

- In lateral view, the superior anal appendage has a dorsal crest at the apex that is angular. The basal width of the spine on the anterior lamina is half the height of the spine or less. The hamular field is shorter than the ventral portion of the hamulus (**Fig. 3.2.478**).23

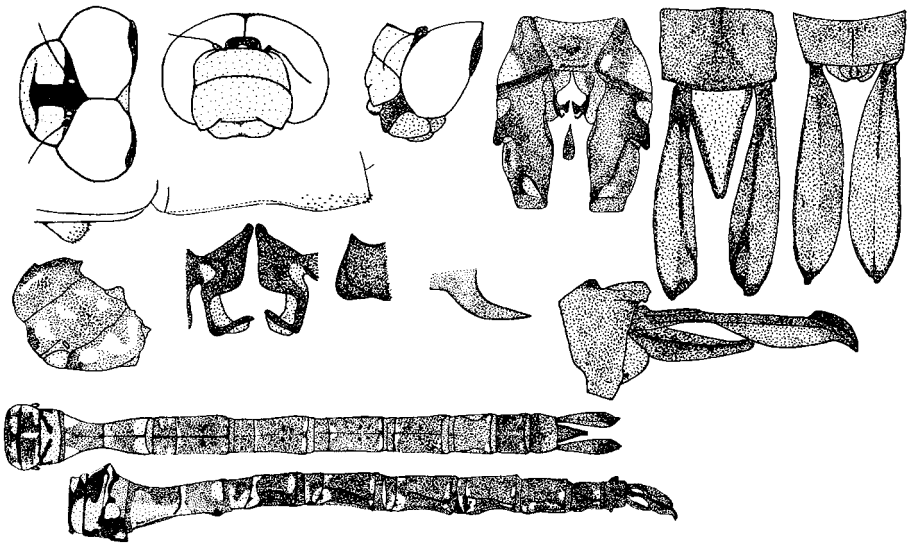


Fig. 3.2.478 *Rhionaeschna biliosa*: head of a male in dorsal, frontal, and lateral view (upper left, left to right); color pattern on the synthorax of a male in lateral view (middle left); lateral profile of the ventral tubercle on the first and second abdominal segments (below views of head); ventral view of the first and second abdominal segments of a male (above, right of center); hamular lobes in posterior and lateral view (left center, left and right, respectively); color pattern on the abdomen of a male in dorsal and lateral view (lower left, top to bottom); apex of the male abdomen in dorsal (upper right center) and lateral view (middle right); apex of the abdomen of a female (upper right); spine on the anterior lamina (center). Based on von Ellenrieder (2003).

23. The cross bar of the T-spot is a fine line. The frons and clypeus are bright yellow, and the labrum is orange. The frontoclypeal groove is not lined by a dark stripe (**Fig. 3.2.478**). There are two teeth on the auricle. Total length: 73 to 79 mm. Hind wing length: 51 to 52 mm. Length of superior anal appendage of male: c. 7.0 to 7.3 mm; female: c. 7.4 mm.

.....*Rhionaeschna biliosa* (Kennedy, 1938)
(Ecuador, Peru, Venezuela). Syn: *Aeshna biliosa* Kennedy, 1938.

- The cross bar of the T-spot is broad. The frons and clypeus are light green or light blue, and the labrum is pale brown. The frontoclypeal groove is lined with a dark stripe (**Fig. 3.2.479**). There are three teeth on the auricle.24

24. The vertical bar on the T-stripe is thicker than the vertex. The pterothoracic stripe covers half to two thirds of the sclerite (**Fig. 3.2.479**). The anterior part of the hamular process appears recurved in posterior view. Total length: 69 to 72 mm. Hind wing length: 49 to 52 mm. Length of superior anal appendage of male: 5.3 to 6.0 mm.

.....*Rhionaeschna condor* (DeMarmels, 2001)
(Venezuela). Syn: *Aeshna condor* DeMarmels, 2001.

- The vertical bar on the T-stripe is narrower than the vertex. The pterothoracic stripe covers 1/4 to 1.3 of the sclerite, and it is constricted in its anterior and posterior parts, sometimes into discrete spots (**Fig. 3.2.480**). The anterior part of the hamular process does not appear recurved in posterior view. Total length: 68 to 73 mm. Hind wing length: 46 to 50 mm. Length of superior anal appendage of male: 5.7 mm; female: c. 6.5 mm.

.....*Rhionaeschna joannisi* (Martin, 1897)
(Venezuela, Colombia, Ecuador, Bolivia). Syn: *Aeshna joannisi* Martin, 1897.

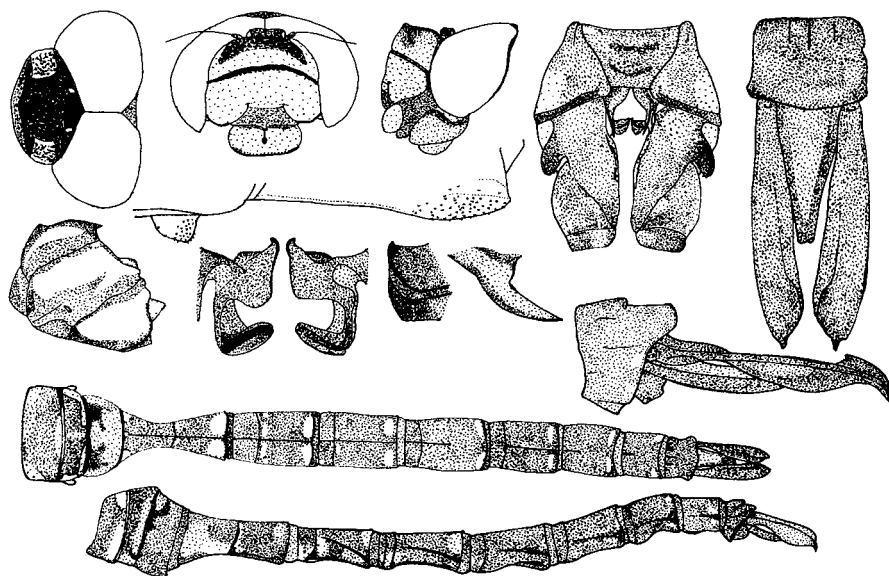


Fig. 3.2.479 *Rhionaeschna condor*: head in dorsal, frontal, and lateral view (upper left, left to right); color pattern on the synthorax of a male in lateral view (upper middle left), lateral profile of the ventral tubercle on the first and male genitalia on the second abdominal segment (below views of head); ventral view of the first and second abdominal segments of a male (upper right center); hamular lobes in posterior (left center) and lateral views (center); color pattern on the abdomen of a male in dorsal and lateral view (below, top and bottom, respectively); apex of the male abdomen in dorsal (upper right) and lateral view (middle right); spine on anterior lamina (center). Based on von Ellenrieder (2003).

25. The ventral tubercle on the first abdominal segment bears fewer than 10 denticles. On the head, there is no dark stripe along the frontoclypeal groove and a wide dark stripe between the frons and compound eye. The basal 1/6 of the membranule of the hind wing is white. Viewed dorsally, the apex of the superior appendage of the male is obtuse (**Fig. 3.2.472**). Total length: 49 to 54 mm. Hind wing length: 35 to 39 mm. Length of superior anal appendage of male: 4.3 to 4.6 mm; female: 4.2 to 4.5 mm.

.....*Rhionaeschna elsia* (Calvert, 1952) pars (Ecuador, Peru, Chile). Syn: *Aeshna* (*Neureclipsa*) *elsia* Calvert, 1952. A species confined to the Galapagos Islands, *Rhionaeschna galapagensis* (Currie, 1901), also has few denticles on the ventral tubercle, but the inner margin of its superior anal appendage is concave, while that of *R. elsia* is convex.

- There more than 10 denticles on the ventral tubercle of the first abdominal segment (**Fig. 3.2.481**).26

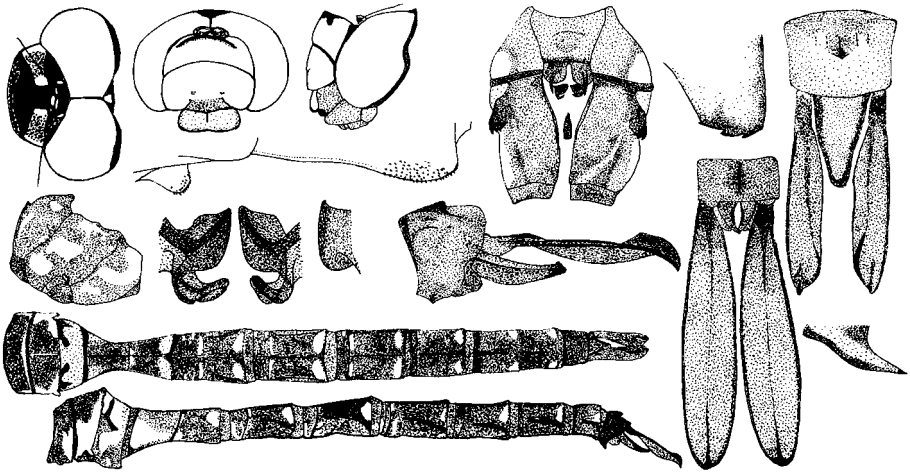


Fig. 3.2.480 *Rhionaeschna joannisi*: head of a male in dorsal, frontal, and lateral view (upper left, left to right); color pattern on the synthorax of a male in lateral view (upper middle left); lateral profile of the ventral tubercle on the first and second abdominal segments (below views of head); ventral view of the first and second abdominal segments of a male (above, right of center) with an enlargement of one of the toothed lateral process on the second segment; hamular lobes in posterior and lateral view (left center, left and right, respectively); color pattern on the abdomen of a male in dorsal and lateral view (lower left, top to bottom); apex of the male abdomen in dorsal (upper right) and lateral view (right of center); apex of the abdomen of a female (lower right center); spine on the anterior lamina (lower right). Based on von Ellenrieder (2003).

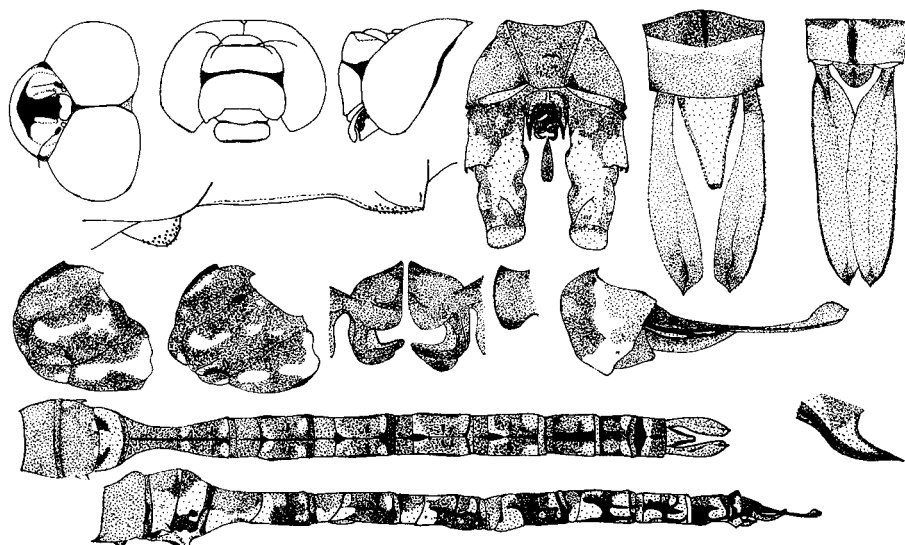


Fig. 3.2.481 *Rhionaeschna brasiliensis*: head in dorsal, frontal, and lateral view (upper left, left to right); color pattern on the synthoraces of two males in lateral view (middle left), lateral profile of the ventral tubercle on the first abdominal segment and male genitalia on the second (below views of head); ventral view of the first and second abdominal segments of a male (upper center); hamular lobes in posterior (left center) and lateral view (right center); color pattern on the abdomen of a male in dorsal and lateral view (below, top to bottom, respectively); apex of the male abdomen in dorsal (upper right center) and lateral view (middle right); apex of the female abdomen (upper right); the spine on the anterior lamina (lower right). Based on von Ellenrieder (2003).

26. The frontal carina on the head in dorsal view forms a rounded angle at the midline. There is a dark stripe on the frontoclypeal groove that widens considerably approaching the compound eye (**Fig. 3.2.481**). Total length: 59 to 66 mm. Hind wing length: 35 to 41 mm. Length of superior anal appendage of male: 4.5 to 5.1 mm; female: 4.6 to 5.6 mm.

.....*Rhionaeschna brasiliensis* (von Ellenrieder and Costa, 2002) (São Paulo, Rio de Janeiro, Paraná, Rio Grande do Sul). Syn: *Aeshna brasiliensis* von Ellenrieder and Costa, 2000.

- The frontal carina in dorsal view is evenly rounded (**Fig. 3.2.482**).27
27. The T-spot on the frons has a stem with sides nearly parallel. The frontoclypeal groove is not lined by a dark stripe, and there is a narrow dark stripe between the frons and the compound eye. The pterostigma is uniform in color. Viewed dorsally, the superior appendages of the male are obtuse at the

apex (**Fig. 3.2.482**). Total length: 50 to 58 mm. Hind wing length: 33 to 40 mm. Length of superior anal appendage of male: 4.5 to 5.2 mm; female: 4.5 to 5.7 mm.

.....*Rhionaeschna bonariensis* (Rambur, 1842)
(Chile, Argentina, Uruguay, Paraguay, Bolivia, Goiás, Paraná, São Paulo, Rio de Janeiro, Santa Catarina, Rio Grande do Sul, Minas Gerais). Syn: *Aeshna bonariensis* Rambur, 1842; *Neureclipsa bonariensis* (Rambur, 1842); *Aeshna dichrostigma* (Selys) Martin, 1908 (*nomen nudum*); *Aeshna litigatrix* Navás, 1911; *Aeshna bonariensis* var. *lutea* Navás, 1920. According to von Ellenrieder (2003), descriptions of this species by some earlier authors are based on specimens of other species that were misidentified.

- The T-spot on the frons has a stem that obviously widens toward the base (Fig. 3.2.483).28

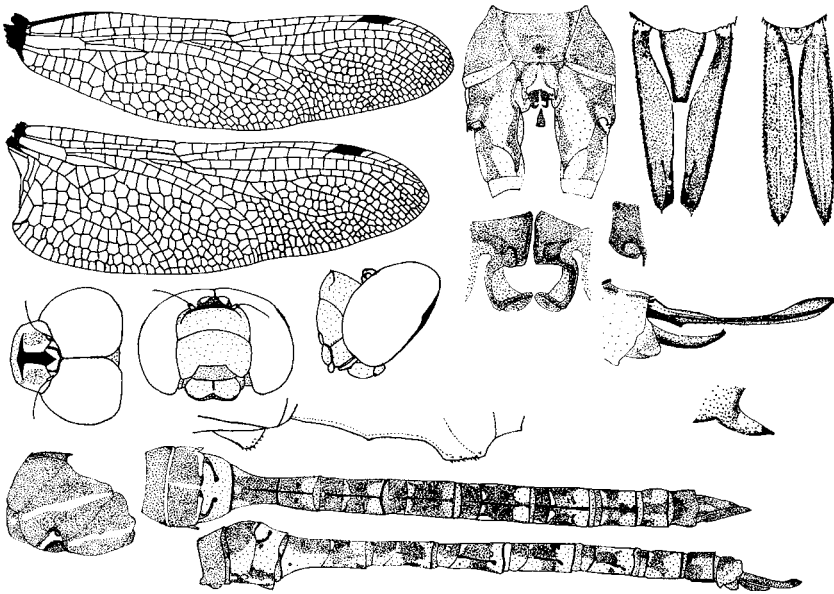


Fig. 3.2.482 *Rhionaeschna bonariensis*: fore and hind wing (upper left); head in dorsal, frontal, and lateral view (middle left, left to right); color pattern on the synthorax of a male in lateral view (lower left), lateral profile of the ventral tubercle on the first and second abdominal segments (below views of head); ventral view of the first and second abdominal segments of a male (upper center); hamular lobes in posterior (center) and lateral view (right of center); color pattern on the abdomen of a male in dorsal and lateral view (lower center, top to bottom); apex of the male abdomen in dorsal (upper right center) and lateral view (middle right); apex of the abdomen of a female (upper right); the spine on the anterior lamina (lower middle right). Based on von Ellenrieder (2003).

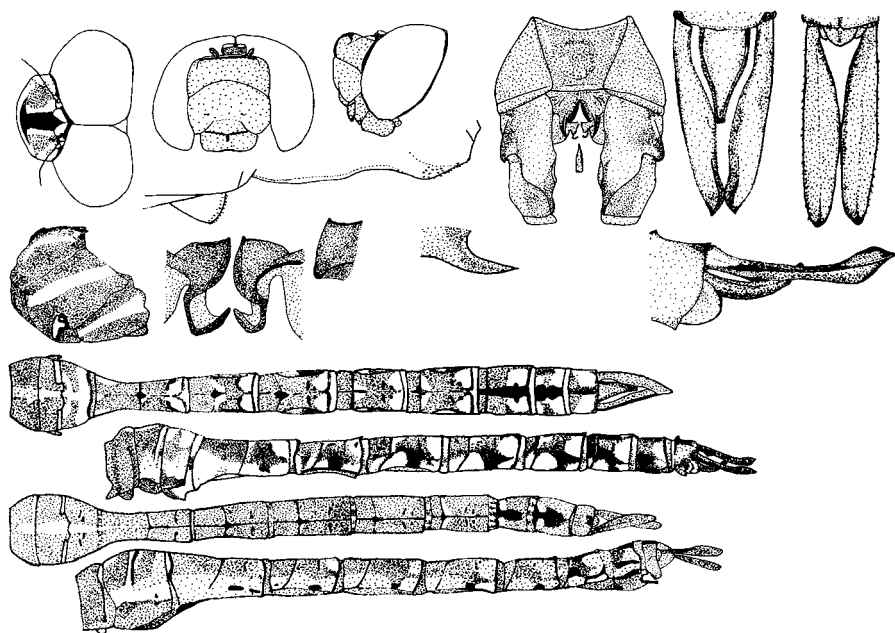


Fig. 3.2.483 *Rhionaeschna confusa*: head in dorsal, frontal, and lateral view (upper left, left to right); color pattern on the synthorax of a male in lateral view (upper middle left), lateral profile of the ventral tubercle on the first and male genitalia in the second abdominal segment (below views of head); ventral view of the first and second abdominal segments of a male (above, third from right); hamular lobes in posterior (left center) and lateral view (left of center); color pattern on the abdomen of a male (lower middle left, top and bottom, respectively) and a female in dorsal and lateral view (lower left, top and bottom, respectively); apex of the male abdomen in dorsal (upper right center) and lateral view (middle right); apex of the female abdomen (upper right); the spine on the anterior lamina (right of center). Based on von Ellenrieder (2003).

28. There is no dark stripe along the frontoclypeal groove (**Fig. 3.2.483**).29
 - There is a dark stripe along the frontoclypeal groove (**Fig. 3.2.484**).30
 29. In lateral view, the ventral tubercle on the first abdominal segment appears triangular and is covered by denticles on its apex and over its posterior surface. The stem of the T-spot has convex sides (**Fig. 3.2.483**). Total length: 48 to 60 mm. Hind wing length: 32 to 42 mm. Length of superior anal appendage of male: 3.8 to 4.5 mm; female: 3.0 to 4.8 mm.

.....*Rhionaeschna confusa* (Rambur, 1842)
 (Argentina, Uruguay, Chile, Rio de Janeiro, Santa Catarina, Rio Grande do Sul).
 Syn: *Aeshna confusa* Rambur, 1842.

- In lateral view, the ventral tubercle on the first abdominal segment appears almost semi-circular and is covered by denticles on both its anterior and posterior surfaces. The stem of the T-spot has parallel or concave sides (**Fig. 3.2.485**). Total length: 56 to 64 mm. Hind wing length: 38 to 41 mm. Length of superior anal appendage of male: 4.4 to 4.8 mm; female: 4.8 to 5.2 mm.

.....*Rhionaeschna marchali* (Rambur, 1842)
(Venezuela, Colombia, Ecuador, Peru, Bolivia). Syn: *Aeshna* (*Hesperaeschna*) *marchali* Rambur, 1842.

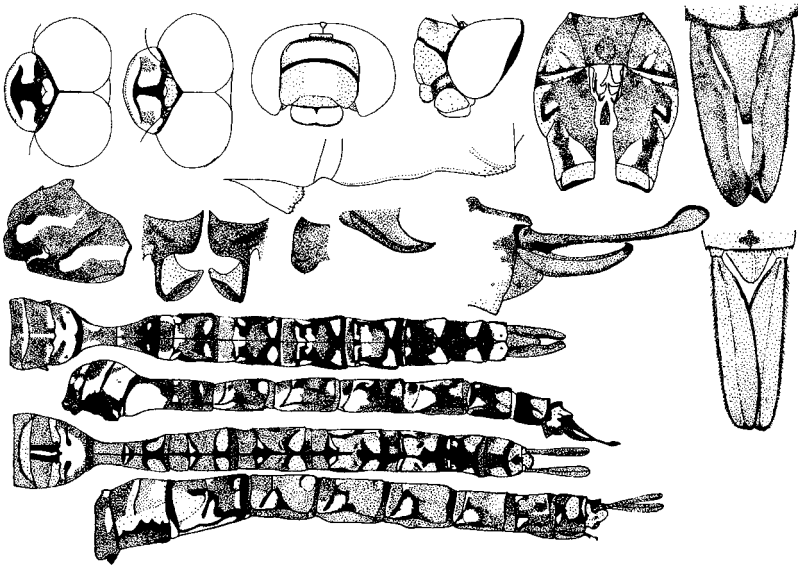


Fig. 3.2.484 *Rhionaeschna variegata*: heads of two individuals in dorsal view and of one in frontal and lateral view (upper left, left to right); color pattern on the synthorax of a male in lateral view (upper middle left), lateral profile of the ventral tubercle on the first and male genitalia of the second abdominal segment (below views of head); ventral view of the first and second abdominal segments of a male (upper right center); hamular lobes in posterior and lateral view (left center, left and right, respectively); color pattern on the abdomen of a male (lower middle left) and a female in dorsal and lateral view (lower left, top and bottom, respectively); apex of the male abdomen in dorsal (upper right) and lateral view (right of center); apex of the abdomen of a female (lower right); the spine on the anterior lamina (center). Based on von Ellenrieder (2003).

30. In dorsal view, the apex of the superior anal appendage forms an obtuse angle (**Fig. 3.2.484**).31

- In dorsal view, the apex of the superior anal appendage is pointed, forming an acute angle. In lateral view, the sub-basal tooth on the superior anal appendage is prominent (**Fig. 3.2.486**).32

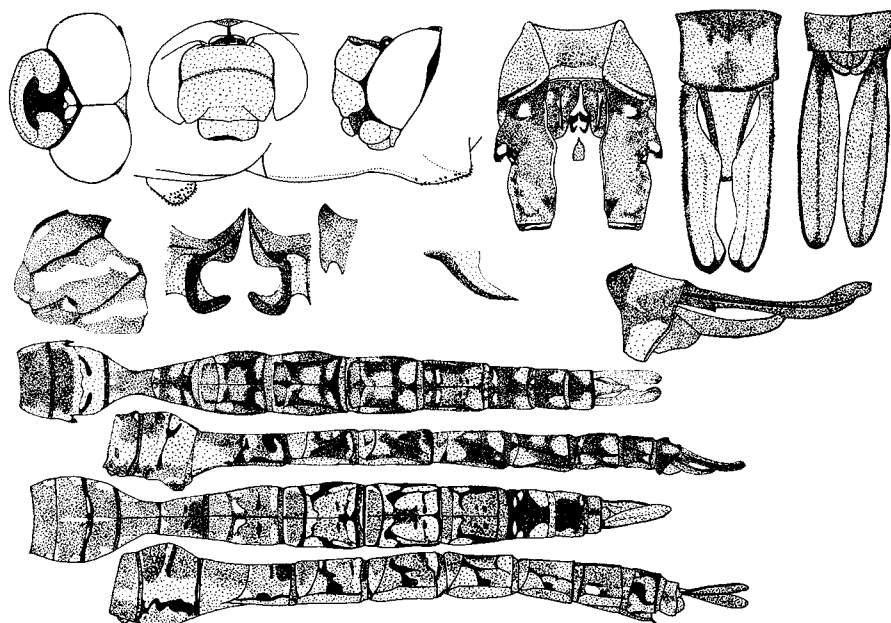


Fig. 3.2.485 *Rhionaeschna marchali*: head in dorsal, frontal, and lateral view (upper left, left to right); color pattern on the synthorax of a male in lateral view (upper middle left), lateral profile of the ventral tubercle on the first and male genitalia in the second abdominal segment (below views of head); ventral view of the first and second abdominal segments of a male (above, third from right); hamular lobes in posterior (left center) and lateral view (left of center); color pattern on the abdomen of a male (lower middle left, top and bottom, respectively) and a female in dorsal and lateral view (lower left, top and bottom, respectively); apex of the male abdomen in dorsal (upper right center) and lateral view (middle right); apex of the female abdomen (upper right); the spine on the anterior lamina (right of center). Based on von Ellenrieder (2003).

31. The superior anal appendage is at least 75% as wide as the widest point in its basal half. The anterior lamina of the male has spines 0.65 to 0.98 mm long (**Fig. 3.2.484**). Total length: 55 to 69 mm. Length of abdomen without anal appendages: 35 to 44 mm. Length of superior anal appendage of male: 4.4 to 5.7 mm; female: 4.4 to 5.5 mm. Hind wing length: 36 to 43 mm. Length of the pterostigma on the fore-wing of the male: 1.8 to 2.9; female: 2.7 to 3.4 mm. Coloration of male: clay yellow face; black pronotum; pale brown ochre propleura; pterothorax brown, pink, or blue green with yellowish or bluish lateral stripes; legs entirely black or with burnt sienna markings on the femora; abdomen burnt sienna on some of the anterior segments and black elsewhere with blue or yellow spots. The female differs from the male in such features as

its pink to olive green frons with pale brown or green markings, its brownish pink synthorax, and its ochraceous abdomen with paler spots.

.....*Rhionaeschna variegata* (Fabricius, 1775) (Chile, Argentina, São Paulo). Syn: *Aeshna* (*Hesperaeschna*) *variegata* Fabricius, 1775; misidentified as *Aeshna* (*Hesperaeschna*) *peralta* Ris, 1918, by Santos (1966a); *Aeshna diffinis* var. *risi* Enderlein, 1912.

- The superior anal appendage is less than 75% as wide as the widest point in its basal half. The pale mesepimeral stripe reaches only 2/3 to 3/4 of the way to the upper margin of the sclerite. The anterior lamina of the male has spines 0.85 mm long (**Fig. 3.2.487**). Total length: 51 to 57 mm. Hind wing length: 31 to 39 mm. Length of superior anal appendage of male: 3.7 to 4.5 mm; female: 3.0 to 4.5 mm.

.....*Rhionaeschna peralta* Ris, 1918 (Peru, Bolivia, São Paulo?). Syn: *Aeshna* (*Hesperaeschna*) *peralta* Ris, 1918.

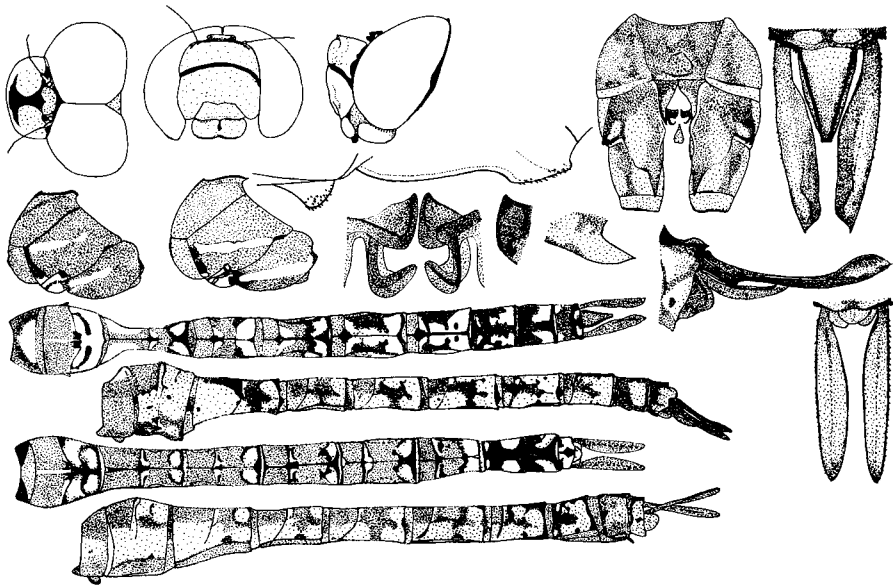


Fig. 3.2.486 *Rhionaeschna absoluta*: head of a male in dorsal, frontal, and lateral view (upper left, left to right); color pattern on the synthorax of two males in lateral view (upper middle left and left center), lateral profile of the ventral tubercle on the first and second abdominal segments (below lateral view of head); ventral view of the first and second abdominal segments of a male (upper right center); hamular lobes in posterior and lateral view (center, left and right, respectively); color pattern on the abdomen of a male (lower middle left) and a female in dorsal and lateral view (lower left, top and bottom, respectively); apex of the male abdomen in dorsal (upper right) and lateral view (middle right); apex of the abdomen of a female (lower right); the spine on the anterior lamina (right of center). Based on von Ellenrieder (2003).

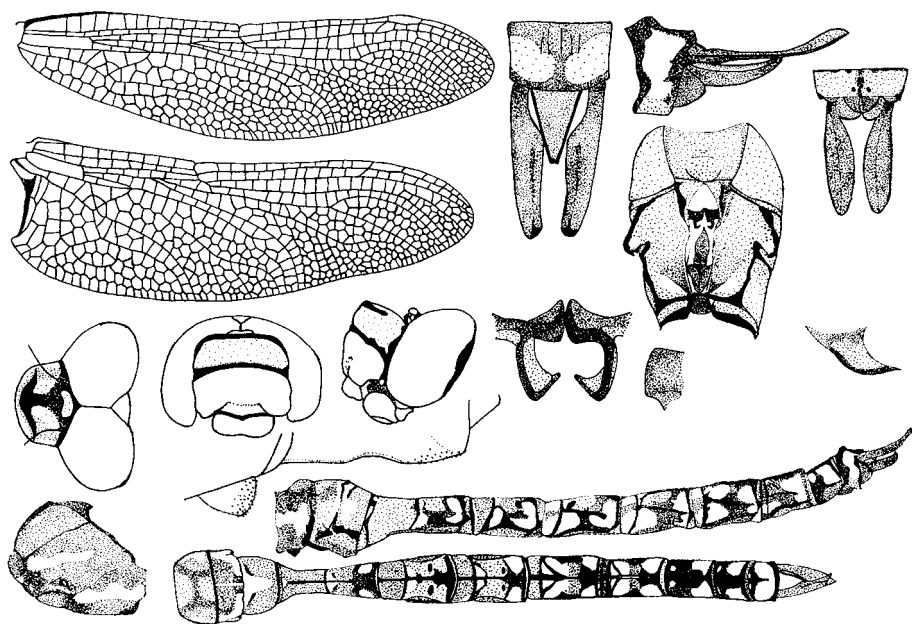


Fig. 3.2.487 *Rhionaeschna peralta*: fore and hind wing (upper left); head in dorsal, frontal, and lateral view (middle left, left to right); color pattern on the synthorax of a male in lateral view (lower left), lateral profile of the ventral tubercle on the first and male genitalia of the second abdominal segment (below views of head); ventral view of the first and second abdominal segments of a male (upper right from center); hamular lobes in posterior (center) and lateral view (right of center); color pattern on the abdomen of a male in lateral and dorsal view (lower right, above and below, respectively); apex of a male abdomen in dorsal (upper center) and lateral view (upper right center); apex of the abdomen of a female (upper right); spine on the anterior lamina (middle right). Based on von Ellenrieder (2003).

32. In dorsal view, the superior anal appendage appears widest just proximal to its apex. The basal 1/3 or more of the membranule of the hind wing is white. (**Fig. 3.2, 3.2.488**). Total length: 49 to 60 mm. Length of male abdomen without anal appendages: 30.5 to 42 mm; female: 33 to 38 mm. Length of superior anal appendage of the male: 4.3 to 5.3 mm; female: 3.4 to 4.3 mm. Hind wing length: 34 to 40 mm. Length of the pterostigma along the costal vein of the male: 2.5 to 3.4 mm; female: 2.5 to 4.2 mm. Color: face of male greenish blue, and that of female blue. There are no antehumeral stripes or spots. The wings are colorless

or faintly yellow and pale yellow. The anterior veins are pale brown, and the rest are black.

.....*Rhionaeschna diffinis* (Rambur, 1842)
(Chile, Argentina, with disputed reports from Peru, Uruguay, São Paulo, Rio Grande do Sul). Syn: *Aeshna* (*Neureclipsa*) *diffinis* Rambur, 1842; *Aeschna configurata* Hagen, 1855 (nomen nudum). According to Calvert (1956), the specimens from the Atlantic slope of the Andes are significantly larger than those from the Pacific slope.

- In dorsal view, the widest point on the superior anal appendage is in its basal half, or it is equally wide near the apex and in its basal half (**Fig. 3.2.486**).33

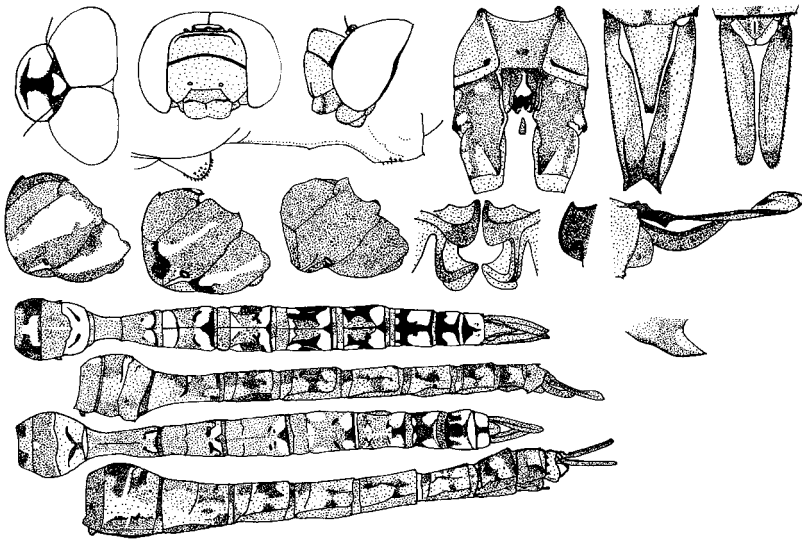


Fig. 3.2.488 *Rhionaeschna diffinis*: head in dorsal, frontal, and lateral view (upper left, left to right); variable color pattern on the synthorax of three different males in lateral view (upper middle left to center); lateral profile of the ventral tubercle on the first and male genitalia of the second abdominal segment (below views of head); ventral view of the first and second abdominal segments of a male (above, right of center); hamular lobes in posterior and lateral views (center and right center, respectively); color pattern on the abdomen of a male and a female, each in dorsal and lateral view (lower left, top to bottom); apex of the male abdomen in dorsal (upper right center) and lateral view (upper middle right); apex of the female abdomen in dorsal view (upper right); spine on the anterior lamina (lower right). Based on von Ellenrieder (2003).

33. Beyond the sub-basal tooth, the inner margin of the superior anal appendage appears convex for its entire length in dorsal view (**Fig. 3.2.486**). The basal 1/5 to 1/7 of the membranule on the hind wing is white. Total length: 42 to 60 mm.

Length of male abdomen without anal appendages: 34 to 36 mm; female: 32.5 to 36 mm. Length of superior anal appendage of the male: 4.1 to 5.1 mm; female: 3.8 to 4.9 mm. Hind wing length: 32 to 42 mm. Length of the pterostigma along the costal vein of the male: 2.3 to 3.5 mm; female: 2.8 to 3.3 mm. Color: synthorax pale greenish yellow with a bluish antehumeral stripe and pale yellow mesepimeral stripe. The pterostigma is brown ochre to pale Vandyke brown.

.....*Rhionaeschna absoluta* (Calvert, 1952)
(Peru, Chile, Argentina, Uruguay). Syn: *Aeshna absoluta* Calvert, 1952; *Aeshna* (*Neureclipsa*) *diffinis absoluta* Calvert, 1952.

- Beyond the sub-basal tooth, the inner margin of the superior anal appendage appears concave for much of its length in dorsal view (**Fig. 3.2.489**). Total length: 43 to 55 mm. Hind wing length: 32 to 39 mm. Length of superior anal appendage of male: 3.7 to 4.3 mm; female: 3.8 to 4.4 mm.

.....*Rhionaeschna tinti* (von Ellenrieder, 2000)
(Chile). Syn: *Aeshna tinti* von Ellenrieder, 2000.

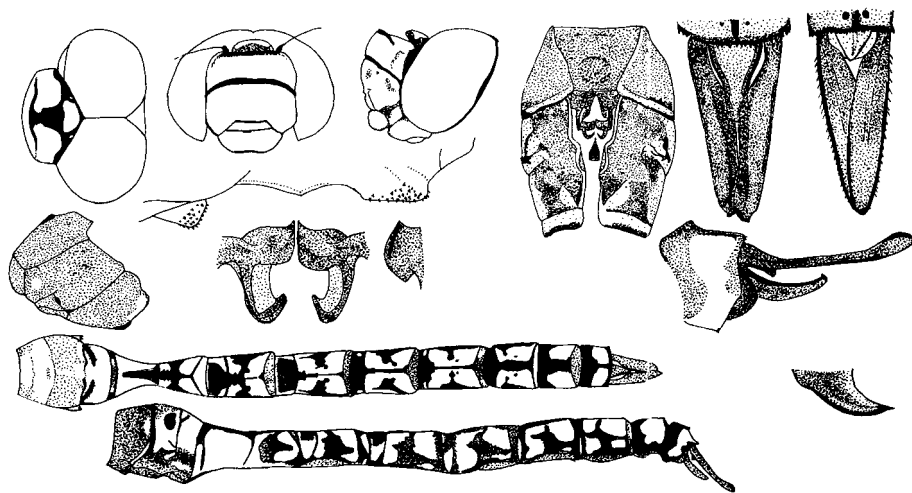


Fig. 3.2.489 *Rhionaeschna tinti*: head in dorsal, frontal, and lateral view (upper left, left to right); color pattern of the synthorax of a male in lateral view (middle left), lateral profile of the ventral tubercle on the first and male genitalia of the second abdominal segment (below views of head); ventral view of the first and second abdominal segments of a male (upper center); hamular lobes in posterior (left center) and lateral view (center); color pattern on the abdomen of a male in dorsal and lateral view (below, top to bottom, respectively); apex of the male abdomen in dorsal (upper right center) and lateral view (middle right); apex of the female abdomen (upper right); the spine on the anterior lamina (lower right). Based on von Ellenrieder (2003).

Key to the species of adult female *Rhionaeschna* in South America

Information for the key was provided by Calvert (1956) and von Ellenrieder (2003), who provided tentative descriptions of the females of two species, *Rhionaeschna condor* and *R. decessus*, although specimens of females had not been described. The subspecies recognized by earlier authors were not accepted by von Ellenrieder (2003). They are nevertheless noted in the key. Unless otherwise stated, the body dimensions are shown as combined ranges for both sexes. No description of a female *Rhionaeschna serrana* has been provided.

1. Pale markings are absent from the synthorax and the seventh through tenth abdominal segments. In lateral view, the frons is elevated above the level of the vertex. There is a spine at the apex of the superior anal appendage (**Fig. 3.2.426**). Total length: 77 to 82 mm. Hind wing length: 49 to 56 mm. Length of superior anal appendage of male: c. 6.5 mm; female: 2.5 to 2.6 mm.

.....*Rhionaeschna draco* (Rácenis, 1958)
(Venezuela). Syn: *Aeshna draco* Rácenis, 1958.

- There are pale spots on the fourth through eight abdominal segments and sometimes on the ninth and tenth, as well. In lateral view, the frons appears below the vertex. The apex of the superior anal appendage lacks a spine (**Fig. 3.2.461**).2

2. The black and pale areas on the synthorax form a marbled pattern (**Fig. 3.2.461**).subgenus *Marmaraeschna*.....3

- The synthorax is dark with pale stripes (**Fig. 3.2.458**).
.....subgenus *Neureclipsa*.....9

3. There is only a slight constriction in the third abdominal segment (**Fig. 3.2.461**). The length of the superior anal appendage is 1.7 to 2.3 mm.4

- There is a deep constriction in the third abdominal segment (**Fig. 3.2.463**). The length of the superior anal appendage is 2.7 to 6.5 mm.6

4. In anterior view, the frontal carina forms a straight line (**Fig. 3.2.461**). Total length: 59 to 60 mm. Hind wing length: 43 to 51 mm. Length of superior anal appendage of male: 4.1 to 4.7 mm; female: 1.8 to 2.2 mm.

.....*Rhionaeschna pallipes* (Fraser, 1947)
(Argentina). Syn: *Aeshna (Marmaraeschna) pallipes* Fraser, 1947.

- In anterior view, a median cleft is seen in the frontal carina (**Fig. 3.2.457**).5

5. The median cleft in the frontal carina is shallow. On the fourth abdominal segment, the inner and outer carinae of the ventral tergites form sigmoid curves. There is one black spot on the mesanepisternum, two on the mesepimeron, one or two on the metepisternum, and one on the metepimeron (**Fig. 3.2.457**). Total length: 37 to 70 mm. Hind wing length: 41 to 46 mm. Length of superior anal appendage of male: 4.2 to 4.8 mm; female: 1.9 to 2.3 mm.

.....*Rhionaeschna brevifrons* (Hagen, 1861)
(Mexico, Central America, Venezuela, Peru, Chile, Paraguay). Syn: *Aeshna brevifrons* Hagen, 1861; *Aeshna (Rhionaeschna) maita* Förster, 1909.

- The median cleft in the frontal carina is deep. On the fourth abdominal segment, the inner and outer carinae of the ventral tergites are straight and parallel. There are two or three black spots on the mesanepisternum, four or five on the mesepimeron, and three on the metepimeron (**Fig. 3.2.460**). Total length: 56 to 59 mm. Hind wing length: 13 to 17 mm. Length of superior anal appendage of male: 3.5 to 4.5 mm; female: 1.7 to 2.2 mm.

.....*Rhionaeschna fissifrons* (Muzón and von Ellenrieder, 2001) (Peru, Bolivia, Chile, Argentina). Syn: *Aeshna* (*Marmaraeschna*) *fissifrons* Muzón and von Ellenrieder, 2001. The specimens from Peru referred to as *Rhionaeschna intricata* by Calvert (1956), who provided a supplemental description and illustrations, actually belong to this species (Muzón and von Ellenrieder, 2001).

6. The superior anal appendage of the female is 2.7 to 3.7 mm long. The total length is 66 to 74 mm.7

- The superior anal appendage of the female is 4.9 to 6.0 mm long. The total length is 72 to 81 mm.8

7. The vertical stem on the T-spot narrows considerably before meeting the cross arm. The ventral tubercle on the first abdominal segment is about twice as long as its height (**Fig. 3.2.463**). Total length: 66 to 68 mm. Hind wing length: 46 to 51 mm. Length of superior anal appendage of male: 4.9 to 5.5 mm; female: c. 3.7 mm.

.....*Rhionaeschna intricata* (Martin, 1908) (Mexico through Colombia, Ecuador, Peru, and Venezuela to Argentina and Chile and throughout Brazil). Syn: *Aeshna* (*Marmaraeschna*) *intricata* Martin, 1908. According to Muzón and von Ellenrieder, (2001), the specimens from Peru described and illustrated under the name of *Aeshna intricata* by Calvert (1956) actually belong to the species *Rhionaeschna fissifrons*.

- The vertical stem of the T-spot is broad where it joins the cross arm. The ventral tubercle on the first abdominal segment is more than three times as long as high (**Fig. 3.2.459**). Total length: 66 to 74 mm. Hind wing length: 48 to 52 mm. Length of male superior anal appendage: 5.4 to 6.0 mm; female: 2.7 to 3.0 mm.

.....*Rhionaeschna brevicercia* (Muzón and von Ellenrieder, 2001) (Colombia, Ecuador, Venezuela). Syn: *Aeshna* (*Marmaraeschna*) *brevicercia* Muzón and von Ellenrieder, 2001.

8. The vertical stem on the T-spot narrows considerably before meeting the cross arm. The anterior 70% of the vertex is yellow, and the posterior 30% is black. The inner and outer margins of the superior anal appendage are nearly parallel, and its apex is not acutely pointed (**Fig. 3.2.464**). Total length: 72 to 77 mm. Hind wing length: 47 to 55 mm. Length of superior anal appendage of male: 5.8 to 6.4 mm; female: 4.9 to 5.7 mm.

.....*Rhionaeschna vigintipunctata* (Ris, 1918) (Venezuela, Peru, Bolivia, Argentina). Syn: *Aeshna* (*Marmaraeschna*) *vigintipunctata* Ris, 1918; *Aeschna laticeps* Hagen, 1875 (nomen nudum). Schmidt (1942) considered this name a synonym of *Aeshna brevifrons*.

- The vertical stem on the T-spot is broad where it joins the cross arm. The vertex is entirely black except for a small round yellow spot near the lateral margin on each side. The superior anal appendage widens toward the apex and has an acutely pointed apex (**Fig. 3.2.462**). Total length: 72 to 81 mm. Hind wing length: 47 to 54 mm. Length of superior anal appendage of male: 5.8 to 6.5 mm; female: 5.6 to 6.0 mm.

.....*Rhionaeschna obscura* (Muzón and von Ellenrieder, 2001)
(Chile, Peru, Bolivia). Syn: *Aeshna (Marmaraeschna) obscura* Muzón and von Ellenrieder, 2001.

9. The closest distance between the inner and outer carina on the ventral side of the fourth abdominal segment is less than 0.09 mm. There are two cells between RP_1 and RP_2 in the hind wing beginning at the level of the pterostigma (**Fig. 3.2.458**).10

- The closest distance between the inner and outer carina on the ventral side of the fourth abdominal segment is more than 0.10 mm (**Fig. 3.2.471**).15

10. The superior anal appendages is longer than the combined length of the eighth through tenth abdominal segments and more than 1.15 mm wide (**Fig. 3.2.458**). Total length: 59 to 62 mm. Hind wing length: 36 to 44 mm. Length of superior anal appendage of male: 4.9 to 5.9 mm; female: 7.2 to 8.3 mm.

.....*Rhionaeschna psilus* (Calvert, 1947)
(North and Central America, West Indies, Ecuador, Peru, Venezuela, Argentina). Syn: *Aeshna confusa* Rambur, 1842; probably *Aeshna dominicana* Hagen, 1861 (*nomen nudum*).

- The superior anal appendages is shorter than the combined length of the eighth through tenth abdominal segments and less than 1.10 mm wide (**Fig. 3.2.466**).11

11. There are broad, shallow indentations or none at all in the pale mesepimeral and metepimeral stripes (**Fig. 3.2.466**).12

- There are deep, rounded indentations in the pale mesepimeral and metepimeral stripes (**Fig. 3.2.470**).13

12. At its midlength, the pale mesepimeral stripe is only half as wide as at its base. The anterior margin of the ventral tubercle on the first abdominal segment is concave. There is a mucron on the outer margin of the superior anal appendage (**Fig. 3.2.466**). Total length: 63 to 72 mm. Hind wing length: 42 to 45 mm. Length of superior anal appendage of male: 5.0 to 5.5 mm; female: 3.0 to 3.8 mm.

.....*Rhionaeschna nubigena* (DeMarmels, 1989)
(Venezuela). Syn: *Aeshna nubigena* DeMarmels, 1989.

- At its midlength, the pale mesepimeral stripe is as wide or almost as wide as at its base. The anterior margin of the ventral tubercle on the first abdominal segment is convex. The apex of the superior anal appendage is rounded or it has a median point (**Fig. 3.2.468**). Total length: 58 to 67 mm. Hind wing length: 39 to 46 mm. Length of superior anal appendage of male: 5.0 to 5.9 mm; female: 3.4 to 6.5 mm.

.....*Rhionaeschna cornigera* (Brauer, 1865)

(Mexico, Central America, Colombia, Venezuela, Ecuador Peru, Bolivia). Syn: *Aeshna cornigera* Brauer, 1865.

13. The anterior end of the vertical stem of the T-spot narrows abruptly. The superior anal appendage is as long or shorter than the combined length of the ninth and tenth abdominal segments (**Fig. 3.2.470**). Total length: 57 to 59 mm. Hind wing length: 36 to 42 mm. Length of superior anal appendage of male: 4.2 to 5.0 mm; female: 3.1 to 3.5 mm.

.....*Rhionaeschna haarupi* (Ris, 1908)
(Argentina). Syn: *Aeshna (Hesperaeschna) haarupi* Ris, 1908.

- The anterior end of the vertical stem of the T-spot narrows gradually. The superior anal appendage is longer than the combined length of the ninth and tenth abdominal segments (**Fig. 3.2.467**).14

14. The pale mesanepisternal stripes are absent or incomplete and no wider than 25% to 33% of the mesanepisternum. The ventral tubercle on the first abdominal segment is more than three times as long as high. The rounded apex of the superior anal appendage bears a minute spine in the middle (**Fig. 3.2.467**). Total length: 63 to 77 mm. Hind wing length: 44 to 53 mm. Length of superior anal appendage of male: 5.7 to 6.0 mm; female: 5.0 to 6.2 mm.

.....*Rhionaeschna pauloi* (Machado, 1994)
(Paraguay, Paraná, Minas Gerais). Syn: *Aeshna pauloi* Machado, 1994.

- The pale mesanepisternal stripes are complete and cover 50% of the mesanepisternal width. The ventral tubercle on the first abdominal segment is only about twice as long as high. The superior anal appendage is acutely pointed at the apex (**Fig. 3.2.469**). Total length: 57 to 65 mm. Hind wing length: 36 to 44 mm. Length of superior anal appendage of male: 4.1 to 5.4 mm; female: 3.9 to 5.1 mm.

.....*Rhionaeschna planaltica* (Calvert, 1952)
(Colombia, Venezuela, Ecuador Peru, Bolivia, Uruguay Paraguay, Argentina, Mato Grosso, Mato Grosso do Sul, Paraná, Minas Gerais, Espírito Santo, São Paulo, Rio de Janeiro, Santa Catarina, Rio Grande do Sul). Syn: *Aeshna cornigera planaltica* Calvert 1952.

15. There are two rows of cells between veins RP_1 and RP_2 in the hind wing beginning at the level of the pterostigma or proximal to it (**Fig. 3.2.471**).16

- There are two rows of cells between veins RP_1 and RP_2 in the hind wing beginning at the level of the distal end of the pterostigma or distal to it (**Fig. 3.2.465**).23

16. There is a black stripe on the frontoclypeal groove that widens greatly near the compound eyes. The stripes on the synthorax are complete, straight, and narrowing than half the width of the sclerites they cross (**Fig. 3.2.471**).17

- There is no black stripe along the frontoclypeal groove. The stripes on the synthorax are deeply constricted or divided into spots, and at their widest points, they cover more than $\frac{1}{2}$ the width of the sclerites they cross (**Fig. 3.2.478**).20

17. The frons, clypeus, and labrum are orange. There are posterolateral spots on the fourth through ninth abdominal segments, which are fused with midlateral spots on the fourth through eighth segments. Total length of male: c. 78 mm.

Length of abdomen without anal appendages: 59 mm. Length of superior anal appendage: 5.7-5.8 mm. Hind wing length: 51 mm. Length of the pterostigma on the fore-wing: 2.9 to 3.0 mm. The identification is tentative because the female has not been described, but the characteristics in the key are usually common for males and females of this genus.

.....*Rhionaeschna decessus* (Calvert, 1953)
(Rio de Janeiro). Syn: *Aeshna* (*Hesperaeschna*) *decessus* Calvert, 1953.

- The frons, clypeus, and labrum are light yellow or blue. Any posterolateral spots on the fourth through seventh abdominal segments are not fused with midlateral spots on the fourth through eighth segments (**Fig. 3.2.471**).18
18. Hind wing length: at least 50 mm. Length of abdomen, not counting the anal appendages: at least 54 mm. The pale anterolateral spots on the second abdominal segment do not reach the auricles. The pale mid-dorsal spots are not confluent with either the mid-lateral of the posterior dorsal spots. On the ventral side of the first abdominal segment, the tubercle appears smoothly curved and low in lateral view. In lateral view, the ventral tubercle on the first abdominal segment is rounded and low. The black T-spot ends before reaching the ante-frons. The vertex is yellow with black only at its lateral margins. The superior anal appendage is shorter than the combined length of the eighth and ninth abdominal segments but longer than the ninth and tenth combined; its apex is rounded (**Fig. 3.2.471**). Total length: 68 to 82 mm. Length of superior anal appendage of male: 5.7 to 6.1 mm; female: c. 5.5 mm.

.....*Rhionaeschna punctata* (Martin, 1908)
(Mexico?, São Paulo, Minas Gerais, Espírito Santo, Rio de Janeiro, Santa Catarina, Rio Grande do Sul). Syn: *Aeshna* (*Hesperaeschna*) *punctata* Martin, 1908; *Aeshna depravata* Hagen, 1861 (*nomen nudum*); *Aeshna lobata* Hagen, 1861 (*nomen nudum*).

- Hind wing length: less than 48 mm. Length of abdomen, not counting the anal appendages: less than 52 mm. The pale anterolateral spots on the second abdominal segment reach the auricles. The pale mid-dorsal spots are confluent with the mid-lateral spots and also with the posterior dorsal spots on the second abdominal segment (**Fig. 3.2.476**).19
19. The apex of the superior anal appendage is blunter than the dorsal spine on the tenth abdominal segment. Pale anterodorsal spots are absent. The pale median dorsal spots are confluent only on the second abdominal appendage. The pale median lateral and posterolateral pairs of spots are not confluent on the eighth abdominal segment. The pale median lateral spots are elongated ventrally only of the eighth abdominal segment (**Fig. 3.2.476**).

.....*Rhionaeschna itatiaia* (Carvalho and Salgado, 2004)
(Minas Gerais, Rio de Janeiro). Syn: *Aeshna itatiaia* Carvalho and Salgado, 2004. From the description, the validity of this species seems doubtful.

- The apex of the superior anal appendage is more acute than the dorsal spine on the tenth abdominal segment. Pale anterodorsal spots are present on the second through seventh abdominal appendages. The pale median dorsal spots are confluent on the second through seventh abdominal segments. The pale median lateral and posterolateral pairs of spots are confluent on the eighth abdominal segment. The pale median lateral spots are elongated ventrally on the fourth through eighth abdominal segments. In lateral view, the ventral tubercle on the first abdominal segment forms a high trapezoid. The black T-spot extends onto the antefrons. The vertex is yellow on its anterior 1/10 and black on its posterior 3/10. The superior anal appendage is as long as the combined length of the eighth through tenth abdominal segments; its apex is acute and ends in a mucron (**Fig. 3.2.477**). Total length: 68 to 72 mm. Hind wing length: 44 to 48 mm. Length of superior anal appendage of male: 5.7 to 6.1 mm; female: 6.3 to 6.7 mm.

.....*Rhionaeschna eduardoi* (Machado, 1985)
(Minas Gerais). Syn: *Aeshna eduardoi* Machado, 1985.

20. The frons and clypeus are bright yellow, and the labrum is orange. The frontoclypeal groove is not margined in black. The transverse arm of the T-spot is only a thin line (**Fig. 3.2.478**). Total length: 73 to 79 mm. Hind wing length: 51 to 52 mm. Length of superior anal appendage of male: c. 7.0 to 7.3 mm; female: c. 7.4 mm.

.....*Rhionaeschna biliosa* (Kennedy, 1938)
(Ecuador, Peru, Venezuela). Syn: *Aeshna biliosa* Kennedy, 1938.

- The frons, clypeus, and labrum are bright light blue, greenish, or yellow. The frontoclypeal groove is black covered by a black stripe. The transverse arm of the T-spot is broad (**Fig. 3.2.479**).21

21. The vertical base of the T-spot is wider than the vertex. The pale stripes on the synthorax are uninterrupted and cover 1/2 to 4/5 of the sclerites (**Fig. 3.2.479**). Total length: 69 to 72 mm. Hind wing length: 49 to 52 mm. Length of superior anal appendage of male: 5.3 to 6.0 mm. The identification is tentative because the female has not been described, but the characteristics in the key are usually common for males and females of this genus.

.....*Rhionaeschna condor* (DeMarmels, 2001)
(Venezuela). Syn: *Aeshna condor* DeMarmels, 2001.

- The vertical base of the T-spot is narrower than the vertex. The pale stripes on the synthorax are interrupted or indented at both ends and cover only 3/10 to 1/2 of the sclerites (**Fig. 3.2.480**).22

22. The total length is 68 to 73 mm. There are no posterodorsal spots of the eighth through tenth abdominal segments. The lateral margins of the seventh abdominal segment are concave. The superior anal appendage is widest in the middle 3/10 (**Fig. 3.2.480**). Hind wing length: 46 to 50 mm. Length of superior anal appendage of male: 5.7 mm; female: c. 6.5 mm.

.....*Rhionaeschna joannisi* (Martin, 1897)
(Venezuela, Colombia, Ecuador, Bolivia). Syn: *Aeshna joannisi* Martin, 1897.

- The total length is 58 to 68 mm. There are posterodorsal spots of the eighth through tenth abdominal segments. The lateral margins of the seventh abdominal segment are straight. The superior anal appendage is widest in the apical 3/10 (**Fig. 3.2.473**). Hind wing length: 40 to 44 mm. Length of superior anal appendage of male: 5.0 to 5.3 mm; female: 5.0 to 5.9 mm.

.....*Rhionaeschna demarmelsi* von Ellenrieder, 2003 (Venezuela).

23. There is no dark stripe on the frontoclypeal groove (**Fig. 3.2.465**).24

- There is a dark stripe covering the frontoclypeal groove (**Fig. 3.2.281**).28

24. The pale stripe running along the dorsal midline of the second abdominal segment is not complete or it is broken near the middle (**Fig. 3.2.465**). Total length: 67 to 72 mm. Hind wing length: 42 to 46 mm. Length of superior anal appendage of male: 5.7 to 6.2 mm; female: 5.3 to 5.9 mm.

.....*Rhionaeschna jalapensis* (Williamson, 1908) (Mexico, Central America, possibly Venezuela). Syn: *Aeshna* (*Schitzuraeschna*) *jalapensis* Williamson, 1908. Three North American species share some of the characteristics of this species, which is known from Central America but has not yet been confirmed to occur in South America.

- The pale stripe running along the dorsal midline of the second abdominal segment is not interrupted (**Fig. 3.2.485**).25

25. There are 10 to 12 postnodal cross veins in the costal space of the fore-wing, and 10 to 14 in the hind wing. There are incomplete pale mesanepisternal stripes or none at all on the synthorax (**Fig. 3.2.485**). There are two veins crossing the supratrangles of the fore-wing, and there are two cubitoanal cross veins in the hind wing. Total length: 56 to 64 mm. Hind wing length: 38 to 41 mm. Length of superior anal appendage of male: 4.4 to 4.8 mm; female: 4.8 to 5.2 mm.

.....*Rhionaeschna marchali* (Rambur, 1842) (Venezuela, Colombia, Ecuador, Peru, Bolivia). Syn: *Aeshna* (*Hesperaeschna*) *marchali* Rambur, 1842.

- There are 6 to 9 postnodal cross veins in the costal space of the fore-wing, and 6 to 11 in the hind wing. The hind wing has three cubitoanal cross veins (**Fig. 3.2.483**).26

26. In each wing, there are two cross veins in the subtriangle, one to four in the supratriangle of the fore-wing, and one to three in the supratriangle of the hind wing (**Fig. 3.2.483**). Total length: 48 to 60 mm. Hind wing length: 32 to 42 mm. Length of superior anal appendage of male: 3.8 to 4.5 mm; female: 3.0 to 4.8 mm.

.....*Rhionaeschna confusa* (Rambur, 1842) (Argentina, Uruguay, Chile, Rio de Janeiro, Santa Catarina, Rio Grande do Sul). Syn: *Aeshna confusa* Rambur, 1842.

- In each wing, there is only one cross vein in the subtriangle, and each supratriangle is not crossed or it is crossed by only one vein (**Fig. 3.2.482**).27

27. The lobes of the clypeus are angular. The sides of the vertical stem of the T-spot are parallel. The basal 15% of the membranule is pale, and the rest is dark.

The posterior surface of the ventral tubercle on the first abdominal segment is covered by many denticles. The apex of the superior anal appendage is acutely pointed (**Fig. 3.2.482**). Total length: 50 to 58 mm. Hind wing length: 33 to 40 mm. Length of superior anal appendage of male: 4.5 to 5.2 mm; female: 4.5 to 5.7 mm.

.....*Rhionaeschna bonariensis* (Rambur, 1842)
(Chile, Argentina, Uruguay, Paraguay, Bolivia, Goiás, Paraná, São Paulo, Rio de Janeiro, Santa Catarina, Rio Grande do Sul, Minas Gerais). Syn: *Aeshna bonariensis* Rambur, 1842; *Neureclipsa bonariensis* (Rambur, 1842); *Aeshna dichrostigma* (Selys) Martin, 1908 (*nomen nudum*); *Aeshna litigatrix* Navás, 1911; *Aeshna bonariensis* var. *lutea* Navás, 1920. According to von Ellenrieder (2003), descriptions of this species by some earlier authors are based on specimens of other species, that were misidentified.

- The lobes of the clypeus are evenly rounded. The vertical stem of the T-spot widens toward the base. The basal 30% of the membranule is pale, and the rest is dark. The ventral tubercle on the first abdominal segment has only a few denticles near the apex. The apex of the superior anal appendage is not acutely pointed (**Fig. 3.2.472**). Total length: 49 to 54 mm. Hind wing length: 35 to 39 mm. Length of superior anal appendage of male: 4.3 to 4.6 mm; female: 4.2 to 4.5 mm.

.....*Rhionaeschna elsia* (Calvert, 1952) pars
(Ecuador, Peru, Chile). Syn: *Aeshna* (*Neureclipsa*) *elsia* Calvert, 1952. A species confined to the Galapagos Islands, *Rhionaeschna galapagensis* (Currie, 1901), also has few denticles on the ventral tubercle, but the inner margin of its superior anal appendage is concave, while that of *R. elsia* is convex.

28. The apex of the superior anal appendage is acutely pointed. In dorsal view, the sixth abdominal segment is widest $\frac{3}{5}$ of the distance from the anterior to the posterior end (**Fig. 3.2.481**).29

- The apex of the superior anal appendage is rounded. In dorsal view, the sixth abdominal segment is widest $\frac{3}{10}$ of the distance from the anterior to the posterior end (**Fig. 3.2.484**).30

29. There is no black stripe along the dorsal midline of the second abdominal segment. The pale stripe on the metepimeron is broken into a dorsal spot shaped like a T and a round ventral spot. In dorsal view, the frontal carina is angular in the middle (**Fig. 3.2.481**). There is always a cross vein in each supratriangle. Total length: 59 to 66 mm. Hind wing length: 35 to 41 mm. Length of superior anal appendage of male: 4.5 to 5.1 mm; female: 4.6 to 5.6 mm.

.....*Rhionaeschna brasiliensis* (von Ellenrieder and Costa, 2002)
(São Paulo, Rio de Janeiro, Paraná, Rio Grande do Sul). Syn: *Aeshna brasiliensis* von Ellenrieder and Costa, 2000.

- There is an uninterrupted black stripe along the dorsal midline of the second abdominal segment. The pale stripe on the metepimeron is either complete or absent but not divided. In dorsal view, the frontal carina is evenly curved in the middle (**Fig. 3.2.486**). The supratriangle is usually but not always free of a cross vein. Total length: 42 to 60 mm. Length of male abdomen without anal

appendages: 34 to 36 mm; female: 32.5 to 36 mm. Length of superior anal appendage of the male: 4.1 to 5.1 mm; female: 3.8 to 4.9 mm. Hind wing length: 32 to 42 mm. Length of the pterostigma along the costal vein of the male: 2.3 to 3.5 mm; female: 2.8 to 3.3 mm. Color: synthorax pale greenish yellow with a bluish antehumeral stripe and pale yellow mesepimeral stripe. The pterostigma is brown ochre to pale Vandyke brown.

.....*Rhionaeschna absoluta* (Calvert, 1952)
(Peru, Chile, Argentina, Uruguay). Syn: *Aeshna absoluta* Calvert, 1952; *Aeshna (Neureclipsa) diffinis absoluta* Calvert, 1952.

30. Total length: 55 to 69 mm. The superior anal appendage is at least 75% as wide as the widest point in its basal half. The anterior lamina of the male had spines 0.65 to 0.98 mm long. Length of abdomen without anal appendages: 35 to 44 mm. Length of superior anal appendage of male: 4.4 to 5.7 mm; female: 4.4 to 5.5 mm. Hind wing length: 36 to 43 mm. Length of the pterostigma on the fore-wing of the male: 1.8 to 2.9; female: 2.7 to 3.4 mm. Coloration of the female: like the male as described in the previous key but with a pink to olive green frons with pale brown or green markings, a brownish pink synthorax, and an ochraceous abdomen with paler spots (**Fig. 3.2.484**).

.....*Rhionaeschna variegata* (Fabricius, 1775)
(Chile, Argentina). Syn: *Aeshna (Hesperaeschna) variegata* Fabricius, 1775; misidentified as *Aeshna (Hesperaeschna) peralta* Ris, 1918; *Aeshna diffinis* var. *risi* Enderlein, 1912.

- The total length is 47 to just under 55 mm.31

31. The vertical bar to the T-spot narrows abruptly where it joins the cross bar. On the third through ninth abdominal segments, the mid-dorsal and mid-lateral spots are broadly joined (**Fig. 3.2.489**). Total length: 43 to 55 mm. Hind wing length: 32 to 39 mm. Length of superior anal appendage of male: 3.7 to 4.3 mm; female: 3.8 to 4.4 mm.

.....*Rhionaeschna tinti* (von Ellenrieder, 2000)
(Chile). Syn: *Aeshna tinti* von Ellenrieder, 2000.

- The vertical bar to the T-spot narrows gradually from the base to the point where it joins the cross bar. On the third through ninth abdominal segments, the mid-dorsal and mid-lateral spots are separated (**Fig. 3.2.487**).32

32. On the fourth and fifth abdominal segments, the mid-lateral and posterior lateral spots are separated. The supratrangles are always crossed by one or two veins (**Fig. 3.2.487**). Total length: 51 to 57 mm. Hind wing length: 31 to 39 mm. Length of superior anal appendage of male: 3.7 to 4.5 mm; female: 3.0 to 4.5 mm.

.....*Rhionaeschna peralta* Ris, 1918
(Peru, Bolivia, São Paulo). Syn: *Aeshna (Hesperaeschna) peralta* Ris, 1918.

- On the fourth and fifth abdominal segments, the mid-lateral and posterior lateral spots are joined. The supratrangles are seldom crossed by one or two veins (**Fig. 3.2.488**). Total length: 49 to 60 mm. Length of male abdomen without anal appendages: 30.5 to 42 mm; female: 33 to 38 mm. Length of superior anal appendage of the male: 4.3 to 5.3 mm; female: 3.4 to 4.3 mm.

Hind wing length: 34 to 40 mm. Length of the pterostigma along the costal vein of the male: 2.5 to 3.4 mm; female: 2.5 to 4.2 mm. Color: face of male greenish blue, and that of female blue. There are no antehumeral stripes or spots. The wings are colorless or faintly yellow and pale yellow. The anterior veins are pale brown, and the rest are black.

.....*Rhionaeschna diffinis* (Rambur, 1842)
(Chile, Argentina, with disputed reports from Peru, Uruguay, São Paulo, Rio Grande do Sul). Syn: *Aeshna* (*Neureclipsa*) *diffinis* Rambur, 1842; *Aeschna configurata* Hagen, 1855 (nomen nudum). According to Calvert (1956), the specimens from the Atlantic slope of the Andes are significantly larger than those from the Pacific slope.

Key to the species of known *Rhionaeschna* larvae in South America

Information for the key was provided by DeMarmels (1982b), von Ellenrieder (1999, 2001b), and Carvalho and Salgado (2002).

1. The pale marking on the dorsal surface of the sixth abdominal segment is larger than other such markings on the other segments, except sometimes the seventh. The apex of the epiproct is lance-like. The paraprocts are about as long as the epiproct (**Fig. 3.2.490**).2

- There is no pale marking on the sixth abdominal segment, or, if there is, it is not larger than similar markings on other segments. The apex of the epiproct is excavated to leave a pair of lateral spines. The paraprocts are longer than the epiproct (**Fig. 3.2.491**).3

2. The anterior half of the labium has an evenly curving lateral border (**Fig. 3.2.492**).

.....*Rhionaeschna punctata* (Martin, 1908)
(Mexico?, São Paulo, Minas Gerais, Espírito Santo, Rio de Janeiro, Santa Catarina, Rio Grande do Sul). Syn: *Aeshna* (*Hesperaeschna*) *punctata* Martin, 1908; *Aeshna depravata* Hagen, 1861 (nomen nudum); *Aeshna lobata* Hagen, 1861 (nomen nudum).

- The labium narrows abruptly in the apical third, then tapers gradually with nearly straight lateral margins (**Fig. 3.2.490**).

.....*Rhionaeschna draco* (Rácenis, 1958)
(Venezuela). Syn: *Aeshna draco* Rácenis, 1958.

3. The epiproct tapers from the base to the apex gradually and is covered, at least on the dorsal surface by short, strong setae. The general color pattern on the abdomen forms four narrow, dark longitudinal lines, interrupted at the segment margins and ending on the ninth segment (**Fig. 3.2.491**).

.....*Rhionaeschna brasiliensis* (von Ellenrieder and Costa, 2002)
(São Paulo, Rio de Janeiro, Paraná, Rio Grande do Sul).

- The epiproct narrows abruptly at the base, and its apical portion tapers slightly, is parallel sided, or is constricted somewhere along its length. The color

pattern is more diffuse, or the dark longitudinal lines are not narrow (**Fig. 3.2.493**).4

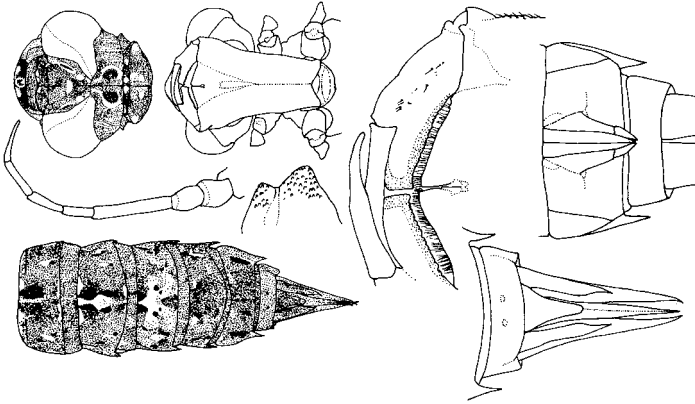


Fig. 3.2.490 *Rhionaeschna draco* larva (above, left to right): head of a male in dorsal view, same head and thorax showing labium in ventral view, labial palp and anterior margin of the prementum of a male in dorsal view, ninth and tenth abdominal segments of a female in ventral view, and the antenna (middle left), supracoxal process on the prothorax of a male (right of antenna), dorsal view of the abdomen of a male (lower left), and apex of the male abdomen in dorsal view (lower right). Based on DeMarmels (1990a).

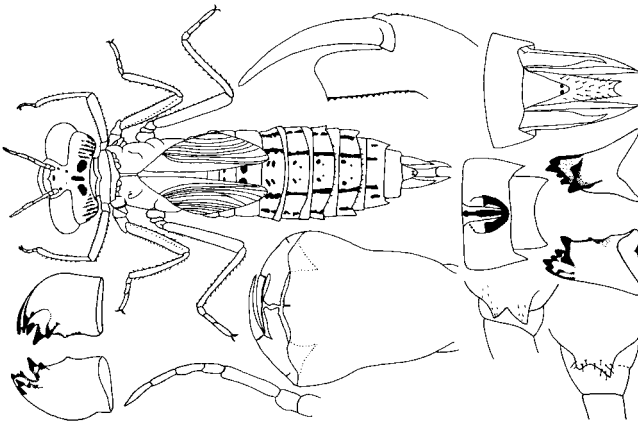


Fig. 3.2.491 *Rhionaeschna brasiliensis* larva: habitus (upper left), antenna (lower left center), labium (lower right center), labial palp (upper center), mandibles in interior (lower left) and posterior view (middle right), dorsal view of the male and female prothoracic apophyses (lower right, left and right, respectively), apex of the abdomen in dorsal view (upper right), and gonapophyses of a female larva in ventral view (right of habitus). Based on von Ellenrieder (2002).

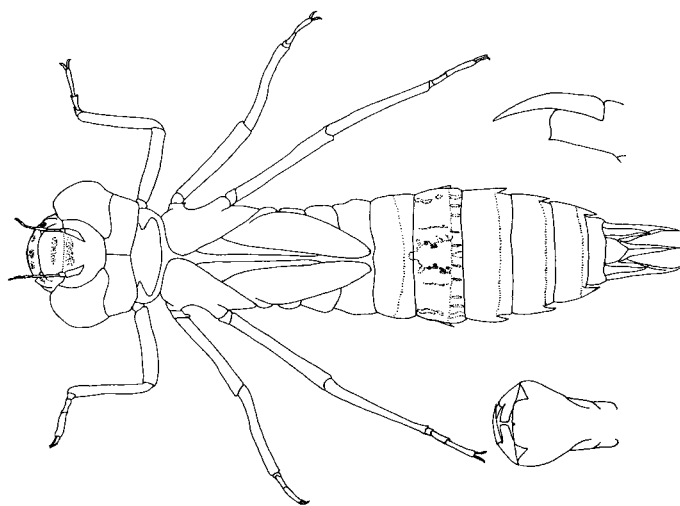


Fig. 3.2.492 *Rhionaeschna punctata* larva: habitus (left), labium in dorsal view (lower right), and the labial palp with its spine (upper right). Based on Santos (1966b).

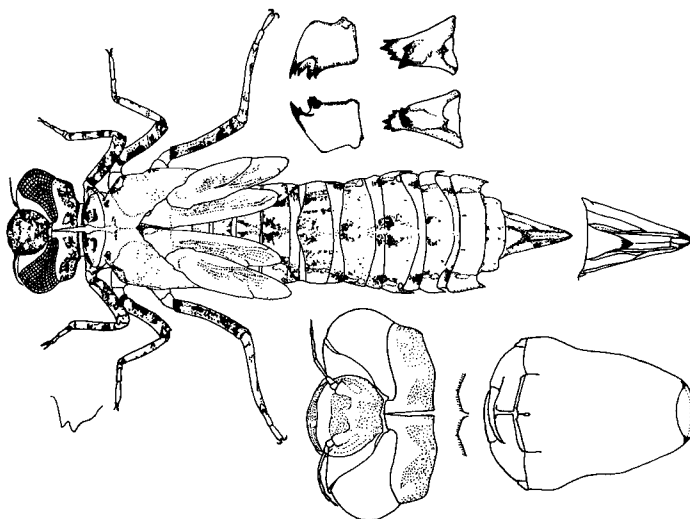


Fig. 3.2.493 *Rhionaeschna absoluta* larva: habitus (middle); outline of the left lateral margin of the prothorax (lower left); head in dorsal view (lower center); labium in dorsal view with an enlarged outline of the anterior margin of the prementum to its left (lower right); the apex of the male larval abdomen in dorsal view enlarged (middle right); the left and right mandibles in posterior (upper left center) and inner views (upper right center). Based on von Ellenrieder (2001b).

4. On each side of the median cleft in the anterior margin of the prementum, there are two blunt teeth as high as the setae along the margin (**Fig. 3.2.17**).

.....*Rhionaeschna confusa* (Rambur, 1842)
(Argentina, Uruguay, Chile, Rio de Janeiro, Santa Catarina, Rio Grande do Sul).
Syn: *Aeshna confusa* Rambur, 1842.

- On each side of the median cleft on the anterior margin of the prementum, there is one small blunt tooth, or such a tooth is vestigial or absent (**Fig. 3.2.493**).5

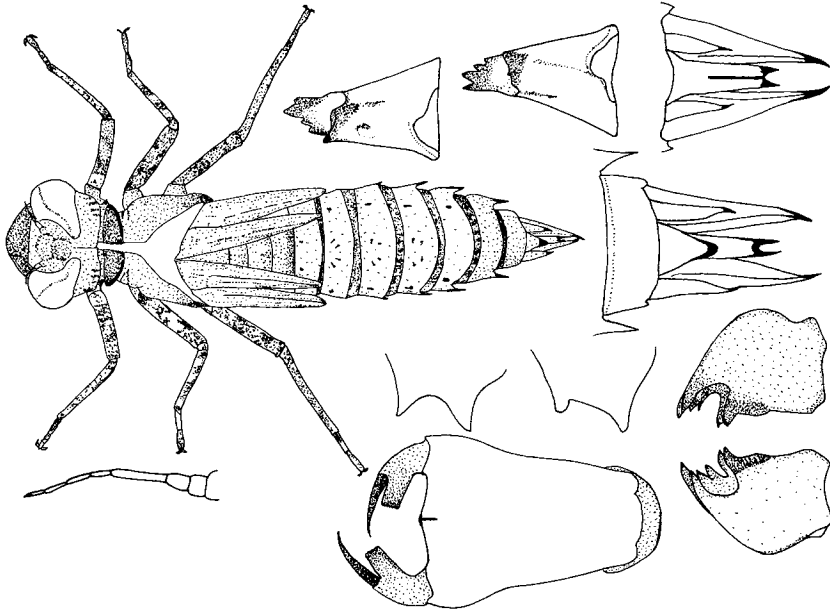


Fig. 3.2.494 *Rhionaeschna pallipes* larva: habitus (upper left), antenna (lower left), labium (lower center), outlines of the prothoracic apophyses of a male and a female (lower center, left and right, respectively), left (upper left center) and right mandible (upper right center) in medial view and both in posterior view (lower right), apex of the male (middle right) and female caudal appendage (upper right) in dorsal view. Based on von Ellenrieder and Muzón (2003).

5. Along the anterior margin of the prementum, a short distance from the median cleft, there is a slight angulation bearing a tubercle-like tooth. The lateral spines on the ninth abdominal segment are as long or longer than those on the eighth, which are less than half as long as the segment. The cerci are only about 2/3 as long as the epiproct (**Fig. 3.2.493**).6

- A tooth beside the median cleft in the prementum, if present, is close to the cleft itself and is not located on a separate angulation (**Fig. 3.2.494**).7

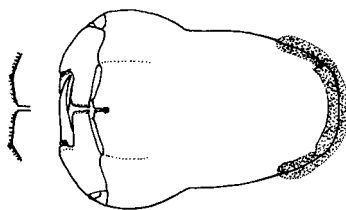


Fig. 3.2.495 Dorsal view of the labium of a *Rhionaeschna diffinis* larva with an enlargement of the median cleft and adjacent lobes of the prementum to its left. Based on von Ellenrieder (2001b).

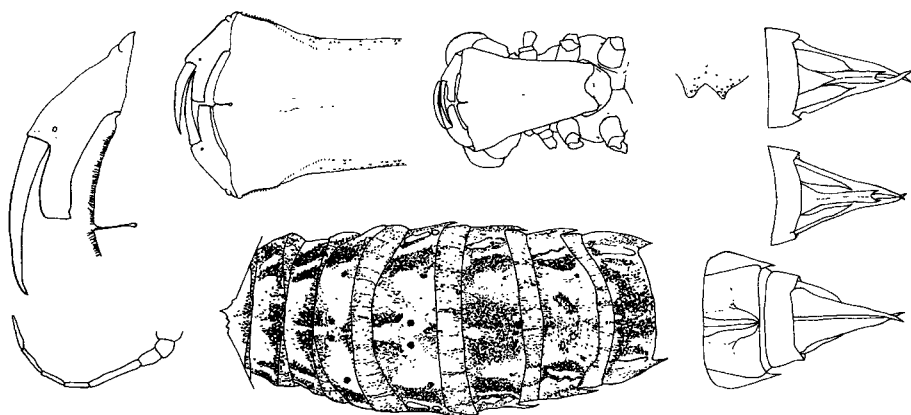


Fig. 3.2.496 *Rhionaeschna joannisi* larva (upper row, left to right): right palp of the labium in dorsal view, anterior portion of the labium in dorsal view, and a ventral view of the mouthparts and parts of the thorax, supracoxal process of the male prothorax, and the apex of the male larval abdomen, and (lower row, left to right): the antenna of a female, color pattern on the anterior surface of the female abdomen, and the apex of the female abdomen in dorsal (middle right) and ventral view (lower right). Based on DeMarmels (2001).

6. The maximum width of the prementum is about 9/10 of its length, and its anterior and posterior sides are evenly curved, with the two curves meeting at an obtuse angle (**Fig. 3.2.495**). When closed and retracted, the labium extends posteriad as far the middle coxae. Total length of final instar: 30 to 34 mm.

.....*Rhionaeschna diffinis* (Rambur, 1842)
 (Chile, Argentina, with disputed reports from Peru, Uruguay, São Paulo, Rio Grande do Sul). Syn: *Aeshna* (*Neureclipsa*) *diffinis* Rambur, 1842; *Aeschna configurata* Hagen, 1855 (nomen nudum). According to Calvert (1956), the specimens from the Atlantic slope of the Andes are significantly larger than those from the Pacific slope. The two species in this couplet were formerly treated as subspecies and are very hard to distinguish.

- The maximum width of the prementum is $\frac{4}{5}$ to $\frac{17}{20}$ of its length, and its sides are sinuous. The base of the posterior prothoracic process is wider than that of the anterior (**Fig. 3.2.493**).

.....*Rhionaeschna absoluta* (Calvert, 1952)
(Peru, Chile, Argentina, Uruguay). Syn: *Aeshna absoluta* Calvert, 1952; *Aeshna*
(*Neureclipsa*) *diffinis absoluta* Calvert, 1952.

7. The base of the posterior prothoracic process is wider than that of the anterior process (**Fig. 3.2.494**).8

- The base of the posterior prothoracic process is equal to or narrower than that of the anterior process, or, if in doubt, the cerci are shorter than $\frac{19}{20}$ of the epiproct length (**Fig. 3.2.496**).11

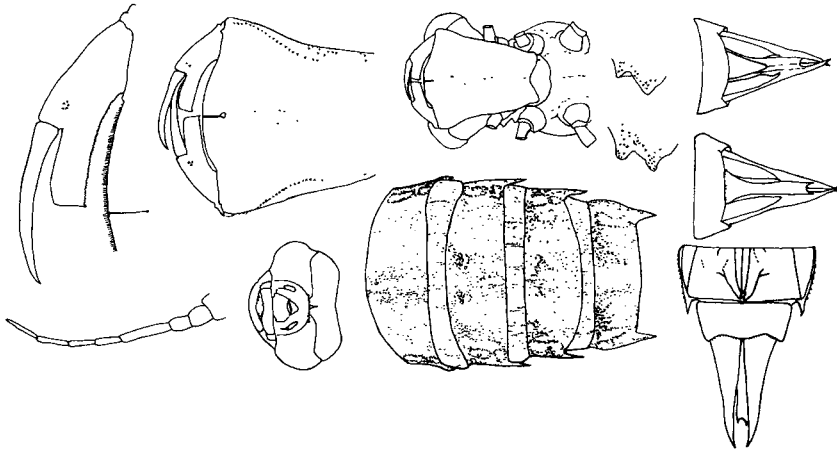


Fig. 3.2.497 *Rhionaeschna condor* larva (upper row, left to right): right palp of the labium in dorsal view, anterior portion of the labium in dorsal view, and a ventral view of the mouthparts and parts of the thorax, supracoxal process of the male (above) and female prothorax (below), and the apex of the male larval abdomen in dorsal view, and (lower row, left to right): the antenna of a female, head of a male in dorsal view, color pattern on the dorsal surfaces of the sixth through ninth segments of the female abdomen, and the apex of the female abdomen in dorsal (middle right) and ventral view (lower right). Based on DeMarmels (2001).

8. The cerci are about $\frac{19}{20}$ as long as the epiproct. The apices of the prothoracic processes are bluntly rounded. The width of the prementum is more than $\frac{4}{5}$ of its length. Total length: 28 to 32 mm.

..... *Rhionaeschna psilus* (Calvert, 1947)
(North and Central America, West Indies, Ecuador, Peru, Venezuela, Argentina). Syn: *Aeshna confusa* Rambur, 1842; probably *Aeshna dominicana* Hagen, 1861 (*nomen nudum*).

- The cerci are much shorter than $\frac{2}{3}$ the length of the epiproct (**Fig. 3.2.494**). The width of the prementum is less than $\frac{4}{5}$ of its length.9
9. The dorsal color pattern on the abdomen is pale with small dark spots (**Fig. 3.2.494**).

.....*Rhionaeschna pallipes* (Fraser, 1947)
(Argentina). Syn: *Aeshna* (*Marmoraeschna*) *pallipes* Fraser, 1947.

- The dorsal color pattern has extensive dark areas, sometimes diffuse, but usually including dark areas flanking a paler dorsal midline (**Fig. 3.2.497**).10

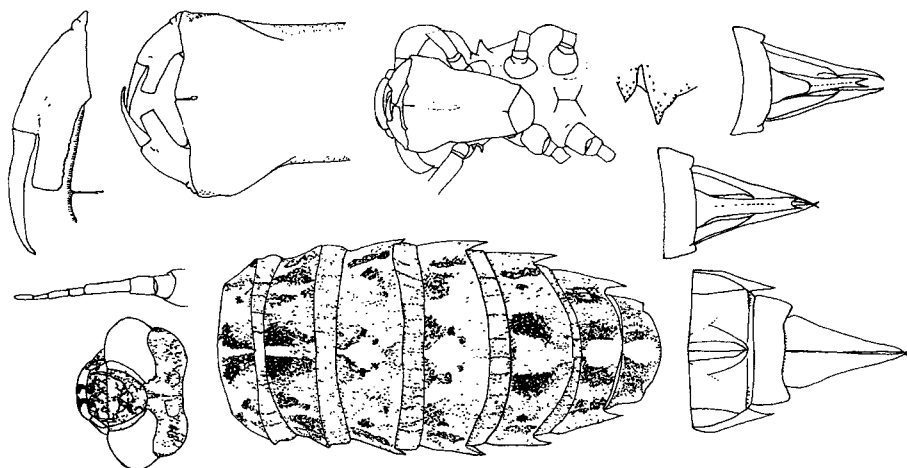


Fig. 3.2.498 *Rhionaeschna vigintipunctata* larva (upper row, left to right): labial palp, anterior part of the labium showing both palps, ventral view of the head and thorax showing the mouth structures, subcoxal processes of the fore-leg of a male larva, the caudal appendages of a male larva in dorsal view; and the antenna of a female (middle left), head of a male in dorsal view (lower left), dorsal view of the abdomen of a male (lower center), and the apex of the abdomen of a female larva in dorsal (middle right) and ventral view (lower right). Based on DeMarmels (2001).

10. The apices of the prothoracic processes are short and blunt. The antennae are long and slender, with all four apical segments more than three times as long as wide. The distal ends of the gonapophysis do not quite reach the posterior margin of the ninth abdominal segment of the female larva. The dorsal color pattern on the abdomen is diffuse and not well defined (**Fig. 3.2.497**).

.....*Rhionaeschna condor* (DeMarmels, 2001)
(Venezuela). Syn: *Aeshna condor* DeMarmels, 2001.

- The apices of the prothoracic processes are relatively long and acutely pointed. The antennae are relatively short, with three or four of the apical segments much shorter than three times as long as wide. The distal ends of the

gonapophysis extend slightly beyond the posterior margin of the ninth abdominal segment of the female larva. The dorsal color pattern on the abdomen is usually sharp and well defined (**Fig. 3.2.498**).

.....*Rhionaeschna vigintipunctata* (Ris, 1918)
(Venezuela, Peru, Bolivia, Argentina). Syn: *Aeshna* (*Marmoraeschna*)
vigintipunctata Ris, 1918; *Aeshna laticeps* Hagen, 1875 (nomen nudum).
Schmidt (1942) considered this name a synonym of *Aeshna brevifrons*.

11. When closed and retracted, the labium extends posteriad as far as a point between the middle and hind coxae. The lateral spines on the sixth abdominal segment are about half as long as the intersegmental membrane between the sixth and seventh segments (**Fig. 3.2.496**).12

- When closed and retracted, the labium does not extend posteriad as far as a point between the middle and hind coxae. The lateral spines on the sixth abdominal segment are much less than half as long as the intersegmental membrane between the sixth and seventh segments. The excavated apex of the epiproct has a median prominence on the dorsal keel (**Fig. 3.2.499**).13

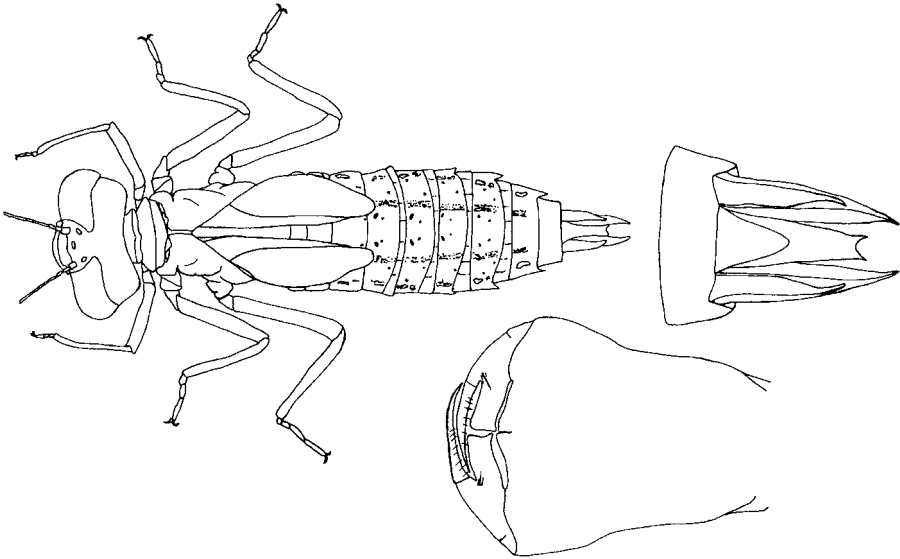


Fig. 3.2.499 *Rhionaeschna variegata* larva: habitus (left), labium in ventral view (lower right), and apex of the abdomen in dorsal view (upper right). Based on a figure labeled *Aeshna peralta* by Santos (1966a).

12. The sides of the prothoracic apophyses meet at a right or slightly obtuse angle. Not counting the moveable hook, the labial palp is roughly three times as long as its maximum width (**Fig. 3.2.496**).

.....*Rhionaeschna joannisi* (Martin, 1897)
(Venezuela, Colombia, Ecuador, Bolivia). Syn: *Aeshna joannisi* Martin, 1897.

- The sides of the prothoracic apophyses meet at an acute angle. Not counting the moveable hook, the labial palp is roughly twice as long as its maximum width. The excavated apex of the epiproct lacks a median prominence on the dorsal keel (**Fig. 3.2.445**).

.....*Rhionaeschna pauloi* (Machado, 1994)
(Paraguay, Paraná, Minas Gerais). Syn: *Aeshna pauloi* Machado, 1994.

13. Any dark transverse bands on the femora and tibiae are indistinct. The apices of the prothoracic processes are acutely pointed. The abdomen has three distinct dark longitudinal stripes on the dorsal surface. The lateral spines on the seventh abdominal segment are less than half the width of the intersegmental membrane between the seventh and eighth segments, and the longest spines are on the eighth segment (**Fig. 3.2.499**).

.....*Rhionaeschna variegata* (Fabricius, 1775)
(Chile, Argentina, São Paulo). Syn: *Aeshna (Hesperaeschna) variegata* Fabricius, 1775; misidentified as *Aeshna (Hesperaeschna) peralta* Ris, 1918, by Santos (1966a); *Aeshna diffinis* var. *risi* Enderlein, 1912.

- There are distinct dark transverse bands on the femora and tibiae. The dorsal coloration of the abdomen is generally uniform. The lateral spines on the seventh abdominal segment are more than half the width of the intersegmental membrane between the seventh and eighth segments (**Fig. 3.2.500**).14

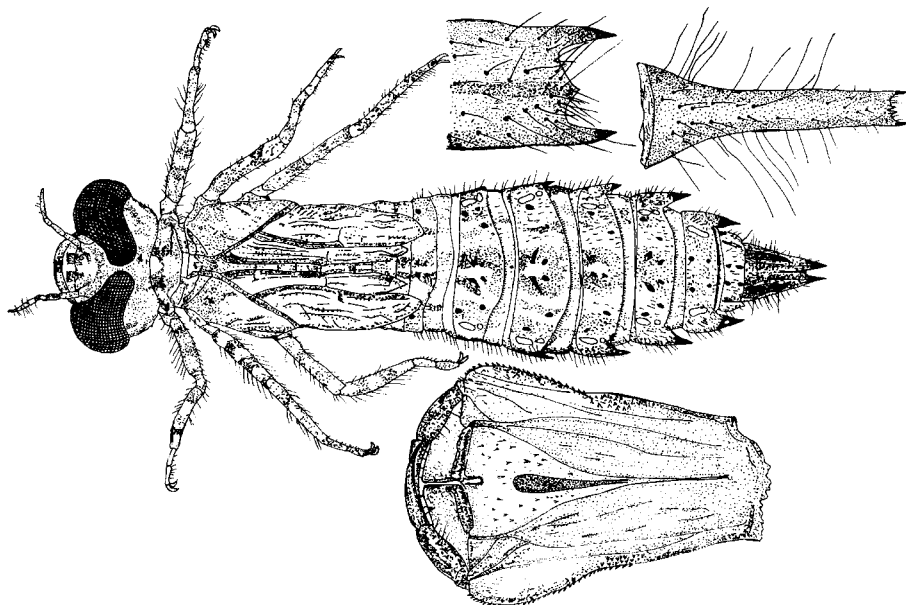


Fig. 3.2.500 *Rhionaeschna bonariensis* larva: habitus of the last larval instar (left), labium in dorsal view (lower right), epiproct of a female larva (upper right), and its apex enlarged (upper center). Based on Rodrigues Capítulo (1980).

14. The lateral spines are on the ninth abdominal segment are as long or longer than those on the eighth. The cerci are only about 2/3 as long as the epiproct, which has a small median prominence between the lateral spines at the apex. The distal ends of the gonapophyses do not reach as far as the posterior margin of the ninth abdominal segment. The sides of the prothoracic apophyses meet at about a right angle. When closed and retracted, the labium extends posteriad as far as a point between the fore and middle coxae. The lateral spine on the eighth abdominal segment is more than half as long as the segment. There are a few long, hair-like setae on the epiproct and a small median tooth in the middle of the apical excavation (**Fig. 3.2.500**).

.....*Rhionaeschna bonariensis* (Rambur, 1842)
(Chile, Argentina, Uruguay, Paraguay, Bolivia, Goiás, Paraná, São Paulo, Rio de Janeiro, Santa Catarina, Rio Grande do Sul, Minas Gerais). Syn: *Aeshna bonariensis* Rambur, 1842; *Neureclipsa bonariensis* (Rambur, 1842); *Aeshna dichrostigma* (Selys) Martin, 1908 (*nomen nudum*); *Aeshna litigatrix* Navás, 1911; *Aeshna bonariensis* var. *lutea* Navás, 1920. According to von Ellenrieder (2003), descriptions of this species by some earlier authors are based on specimens of other species that were misidentified.

- The lateral spines on the eighth abdominal segment are longer than those on the ninth. The cerci are 3/4 to 5/6 as long as the epiproct, which does not have an obvious median prominence at the apex between the lateral spines. The distal ends of the gonapophyses reach as far as the posterior margin of the ninth abdominal segment (**Fig. 3.2.501**).15

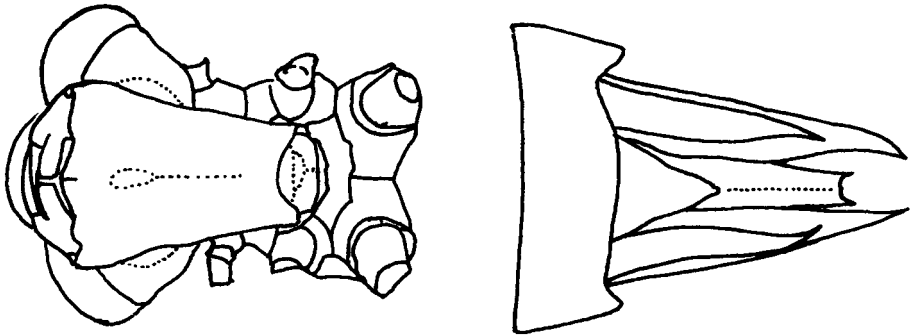


Fig. 3.2.501 *Rhionaeschna planaltica* larva: ventral side of the head and thorax covered largely by the labium (left) and apex of the abdomen in dorsal view (right). Based on DeMarmels (1992d).

15. The teeth on each side of the median cleft on the anterior margin of the prementum are about as long as the setae that line the margin. The cerci are about $4/5$ as long as the epiproct or longer and average about 0.98 of the epiproct length. The width of the prementum is more than $4/5$ of its length. When closed and retracted, the labium extends posteriad as far as the middle coxae (**Fig. 3.2.501**). Total length of final instar: 29 to 34 mm.

.....*Rhionaeschna planaltica* (Calvert, 1952)
(Colombia, Venezuela, Ecuador Peru, Bolivia, Uruguay Paraguay, Argentina, Mato Grosso, Mato Grosso do Sul, Paraná, Minas Gerais, Espírito Santo, São Paulo, Rio de Janeiro, Santa Catarina, Rio Grande do Sul). Syn: *Aeshna cornigera planaltica* Calvert 1952, although von Ellenrieder (1999) still maintains this taxa as a subspecies of *R. cornigera*. The larvae of the two are difficult to distinguish.

- The teeth on each side of the median cleft on the anterior margin of the prementum are vestigial or apparently absent. The cerci are $3/4$ to $5/6$ as long as the epiproct and average 0.85 of the epiproct length. The width of the prementum is about $3/4$ of its length. Dark markings on the abdominal segments form a wide dark mid-dorsal stripe (**Fig. 3.2.502**). Total length of final instar larva: c. 28 to 35 mm.

.....*Rhionaeschna cornigera* (Brauer, 1865)
(Mexico, Central America, Colombia, Venezuela, Ecuador Peru, Bolivia). Syn: *Aeshna cornigera* Brauer, 1865.

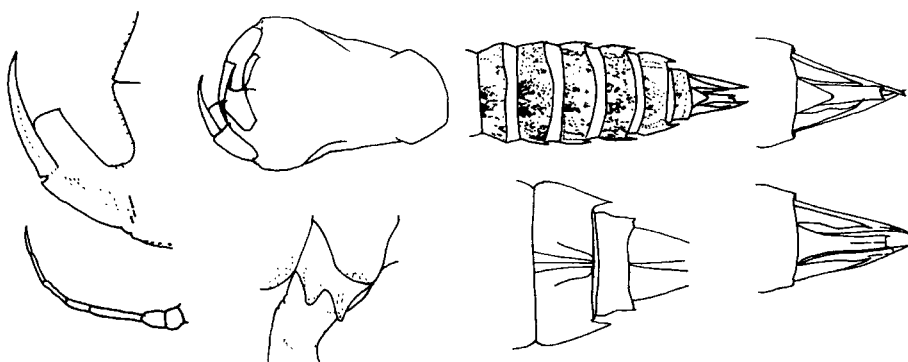


Fig. 3.2.502 *Rhionaeschna cornigera* larva (upper row, left to right): left palp of the labium in dorsal view, labium, color pattern on the dorsal side of the abdomen, and the apex of the male abdomen in dorsal view, and (lower row, left to right): antenna, apophysis on the left side of the prothorax in dorsal view, apical segments of the abdomen of a female larva in ventral view, and apex of the female abdomen in dorsal view. Based on DeMarmels (1982b).

Key to the species of adult *Castoraeschna* in South America

Information for the key was provided by Calvert (1956), Dunkle and Cook (1984), and DeMarmels (1989a).

1. The T-spot on the frons is absent or incomplete, lacking a stem and consisting only of a transverse brown line at the junction of the dorsal and anterior surfaces (**Fig. 3.2.503**).2
- The T-spot on the frons has at least a complete head piece (**Fig. 3.2.504**).4

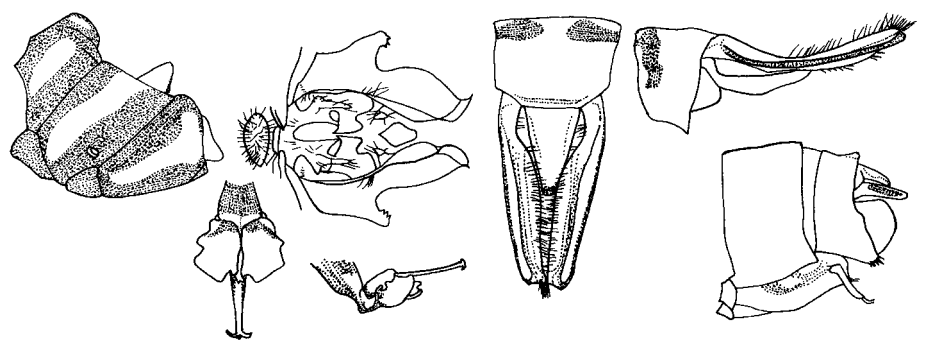


Fig. 3.2.503 *Castoraeschna tepuica*: color pattern on the synthorax (left), male genitalia on the second segment of the abdomen in ventral view (upper left center), penis in ventral and lateral view (lower left center, left and right, respectively), apex of the male abdomen in dorsal (right center) and lateral view (upper right), and the apex of the female abdomen in lateral view (lower right). Based on DeMarmels (1989a).

2. The apical flagellum at the apex of the penis is bifurcate with branches diverging sharply. The superior anal appendage is depressed at the base. The tenth abdominal segment is mainly pale dorsally with the dark markings confined to a pair of narrow dorsolateral markings on the anterior part (**Fig. 3.2.503**). Total length without appendages of male: c. 74 mm; female: c. 82 mm. Length of male abdomen without appendages: c. 54 mm; female: c. 59 mm. Length of male anal appendages: c. 6.6 mm. Hind wing length of male: c. 56 mm; female: c. 59 mm. Color of males and females: head mainly yellow with a black posterior band. The thorax is mainly brown with yellowish green bands. The abdomen is dark ferrugineous with green markings.

.....*Castoraeschna tepuica* DeMarmels, 1989 (Venezuela).

- The apical flagellum at the apex of the penis is not bifurcate at the apex, although a short basal precess may be present (**Fig. 3.2.505**).3

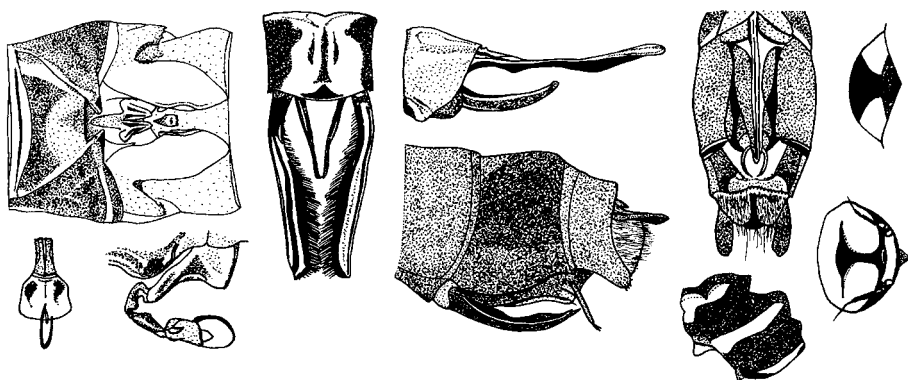


Fig. 3.2.504 *Castoraeschna castor*: color pattern on the vertex and frons of a male (upper right) and a female (lower right), color pattern on the thorax of a male in lateral view (lower right center), male genitalia on the second abdominal segment in ventral view (upper left), penis in ventral and lateral view (lower left, left and right, respectively), apex of the male abdomen in dorsal (left center) and lateral view (upper center), apex of the female abdomen in ventral (upper right center) and lateral view (lower right center). Based on Calvert (1956).

3. The fork in wing vein Rs of the male is asymmetrical, its branches meeting at an angle of 60° to 80° . In lateral view, the male superior anal appendages curve slightly, and each has a low ventral prominence $1/5$ of the distance from the base. The medial edges of their blades lack hair-like setae visible in dorsal view. The green antehumeral stripe at its middle height is 2 mm wide. The green mesothoracic stripe is wider than the posterior brown stripe adjacent to it. The male abdomen was described as probably being brown with grayish green markings, including anterolateral spots covering the area anterior to the transverse carina on the second through sixth segments, small triangular markings on the mid-dorsal surface of the third through seventh segments, and large, roundish spots on the posterodorsal surface of the second through tenth segments (**Fig. 3.2.505**). Hind wing length of male: 46 to 52 mm. Length of male abdomen without cerci: 50.8 to 57.0 mm. Length of male cerci: 7.0 to 7.4 mm. The female has not been described.

.....*Castoraeschna decurvata* Dunkle and Cook, 1984 (Argentina).

- The fork in wing vein Rs is symmetrical, its branches meeting at an angle of about 30° . In lateral view, the male superior anal appendages curve dorsad, and each has a prominent ventral tubercle $1/4$ of the distance from the base. The medial edges of their blades have a dense coat of hair-like setae visible in dorsal view. The green antehumeral stripe at its middle height is narrower than 1.4 mm. The green mesothoracic stripe is narrower than or equal in width to the posterior brown stripe adjacent to it. The ventrolateral tergal processes on the

first abdominal segment of the male are not denticulate at the apex. There are pale posterodorsal spots on the second through tenth abdominal segments. The anal appendages of the female are 1.38 to 1.64 mm long (**Fig. 3.2.506**).

.....*Castoraeschna januaria* (Hagen, 1867)
(Mexico? Paraguay, Argentina, Minas Gerais, São Paulo, Santa Catarina). Syn:
Aeshna januaria Hagen, 1867.

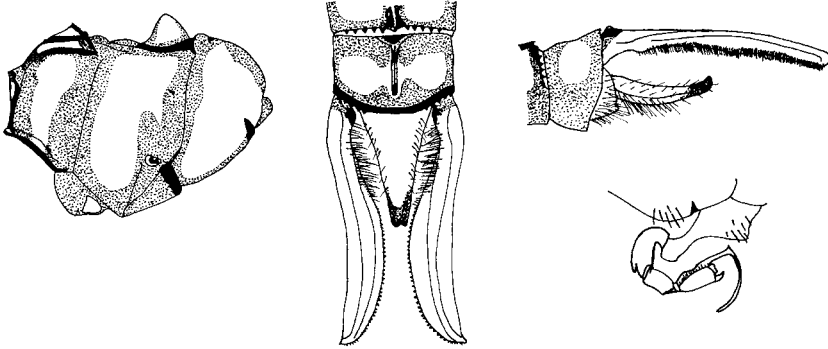


Fig. 3.2.505 *Castoraeschna decurvata* male (left to right): pattern on the pterothorax in lateral view, apex of the abdomen in dorsal and lateral view (above), and the genital lobe and penis in lateral view. Based on Dunkle and Cook (1984).

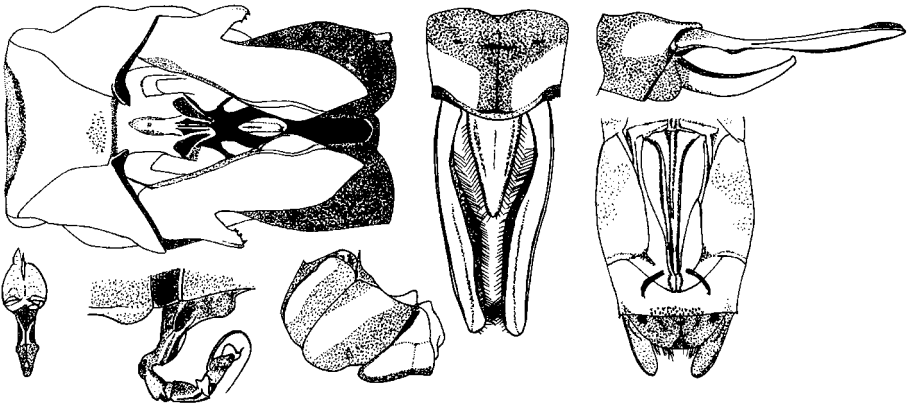


Fig. 3.2.506 *Castoraeschna januaria*: color pattern on the thorax of a male in lateral view (lower center), male genitalia on the second abdominal segment in ventral view (upper left), penis in ventral and lateral view (lower left, left and right, respectively), apex of the male abdomen in dorsal (right center) and lateral view (upper right), apex of the female abdomen in ventral view (lower right). Based on Calvert (1956).

4. The stem of the T-spot on the frons is absent. The superior appendage of the male has neither an inferior sub-basal tubercle nor a tooth. The ventrolateral tergal processes on the first abdominal segment of the male are not denticulate at the apex (**Fig. 3.2.507**). The females have not been described.5
- A wedge or T-shaped spot on the frons is complete with both a head piece and stem, which is triangular in shape with the anterior part widest. The superior appendage of the male may or may not have an inferior sub-basal tubercle or a tooth (**Fig. 3.2.508**).6

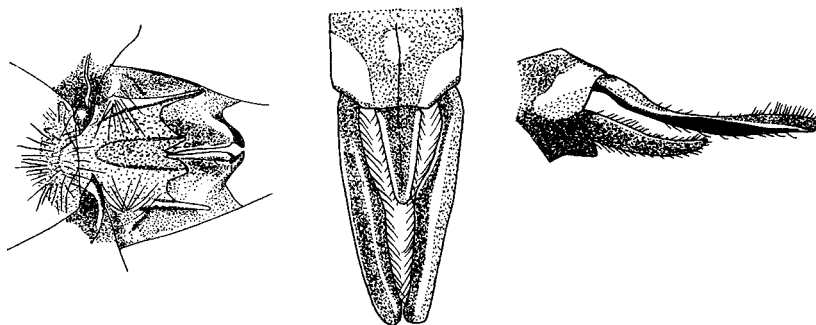


Fig. 3.2.507 *Castoraeschna longfieldae* male (left to right): posterior part of the first and second abdominal segment in ventral view and the apex of the abdomen in dorsal and ventral view. Based on Calvert (1956).

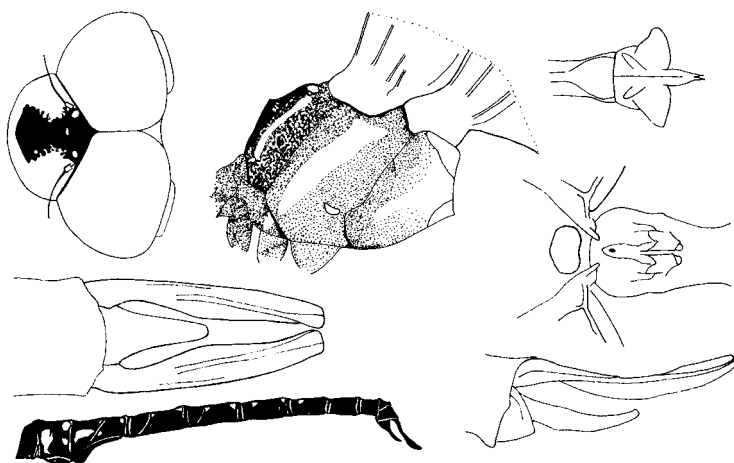


Fig. 3.2.508 *Castoraeschna margarethae* male: head in dorsal view (upper left); thorax in lateral view showing the basal part of the wings (upper center); penis in ventral view (upper left); lateral view of the abdomen, on which the dark markings are black, except for the reddish brown first segment, and the light markings are mainly bluish green (lower left); genitalia on the second abdominal segment in ventral view (middle right); and the apex of the abdomen in dorsal (middle left) and lateral view (lower right). Based on Jurzitza (1979).

5. The posterodorsal pale spots on the second through tenth abdominal tergites are well developed. The superior appendage of the male is rounded at the apex, which does not appear acute viewed either dorsally or laterally (**Fig. 3.2.507**). There are four rows of cells between the branches of the fork at the level of the pterostigma.

.....*Castoraeschna longfieldae* (Kimmins, 1929)
(Mato Grosso). Syn: *Coryphaeschna longfieldae* Kimmins, 1929.

- The posterodorsal pale spots are reduced to narrow transverse stripes on the fourth through eighth abdominal tergites and vestigial or absent on the ninth and tenth. The superior appendage of the male, viewed dorsally, is truncate at such an angle that its distal, lateral angle is acute; viewed dorsally, it is acute at the apex. There are two or three rows of cells between the branches of the fork at the level of the pterostigma (**Fig. 3.2.509**).

.....*Castoraeschna coronata* (Ris, 1918)
(Peru, Bolovia). Syn: *Coryphaeschna coronata* Ris, 1918.

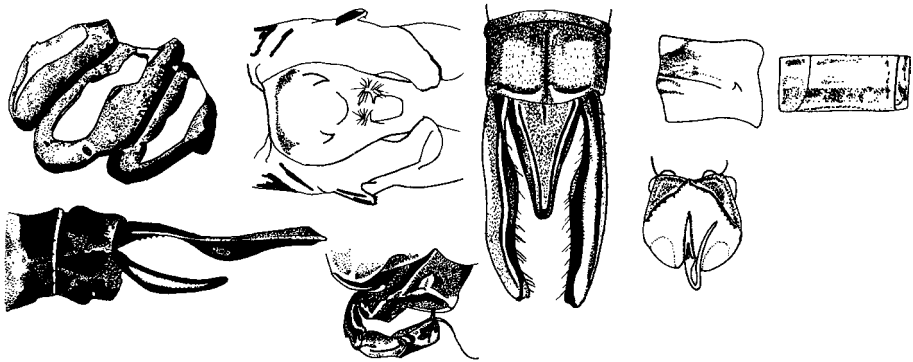


Fig. 3.2.509 *Castoraeschna coronata*: color pattern on the synthorax in lateral view (upper left), male genitalia on the second abdominal segment in ventral view (upper left center), lateral view of the second abdominal segment showing the location of the auricle (upper right center), penis in lateral view (lower center) and its apex in ventral view (lower right), lateral view of the fourth abdominal segment (upper right), and apex of the male abdomen in dorsal (upper center) and lateral view (lower left). Based on Calvert (1956).

6. The superior anal appendages of the male lack inferior, sub-basal tubercles. The pale posterodorsal spots on the abdominal segments of the male are small and present on the second through sixth segments (**Fig. 3.2.508**). The female has not been described.

.....*Castoraeschna margarethae* Jurzitza, 1979
(Minas Gerais, São Paulo).

- The superior anal appendage of the male bears an inferior, sub-basal tubercle. The pale posterodorsal spots on the abdominal segments of the male are large and present on the first through ninth segments (**Fig. 3.2.504**).7
 7. The pale antehumeral and lateral thoracic stripes are relatively narrow. There are well developed, pale posterodorsal spots on the first through fifth abdominal segments of both sexes. The posteroventral tergal processes on the first abdominal segment of the male appear as wide as long when viewed laterally, and the apex does not bear denticles (**Fig. 3.2.504**). Length of abdomen (without appendages): 53 to 57 mm (male) or 50 to 58 mm (female). Hind wing length, male: 50 to 53 mm; female: 51 to 53 mm. Length of the abdominal appendages of the female: 1.06 to 1.47 mm.

.....*Castoraeschna castor* (Brauer, 1865)
 (Argentina, Surinam?, Espirito Santo, Minas Gerais, São Paulo, Rio de Janeiro).
 Syn: *Aeshna castor* Brauer, 1865.

- The pale antehumeral and lateral thoracic stripes are relatively wide. There are well developed, pale posterodorsal spots on the second through tenth abdominal segments of the males and on the third or fourth through the ninth of the females. The posteroventral tergal processes on the first abdominal segment of the male appear 0.14 as wide as long when viewed laterally, and the apex bears denticles on its posterior margin, which are evident when viewed ventrally or laterally (**Fig. 3.2.428**). Length of abdomen (without appendages): 42 mm (male) or 48 mm (female). Hind wing length, male: 40 mm; female: 45 mm. Length of the abdominal appendages of the female: 1.2 mm.

.....*Castoraeschna colorata* (Martin, 1908)
 (Minas Gerais, São Paulo, Paraná). Syn: *Aeshna colorata* (Martin, 1908)

Key to the species of *Castoraeschna* larvae in South America

Information for the key was provided by Santos (1970d), Rodrigues Capítulo and Jurzitza (1989), and DeMarmels (1990a). Because most of the larvae have not been adequately described, only a preliminary key can be presented.

1. The abdominal segments are uniformly patterned with dark anterodorsal markings surrounding small pale areas. The remaining dorsal area of the abdomen is paler with small dark spots arranged in symmetrical pairs on either side of the dorsal midline. The pattern is shown only on the sixth segment in the figure. There are no tubercles beside the mid-dorsal cleft, or such tubercles are shorter than the setae lining the anterior premental margin. Folded beneath the head and thorax, the labium extends beyond the middle coxae (**Fig. 3.2.510**). Total length of final instar: c. 49 mm. The legs are pale with four dark crossbands on the fore and middle femora and three poorly defined cross bands on the hind femur. The wing cases are pale with distinctive brown markings.

.....*Castoraeschna tepuica* DeMarmels, 1989
 (Venezuela).

- The dark markings on the abdomen form a mid-dorsal stripe, at least on most of the tergites (**Fig. 3.2.443**).2

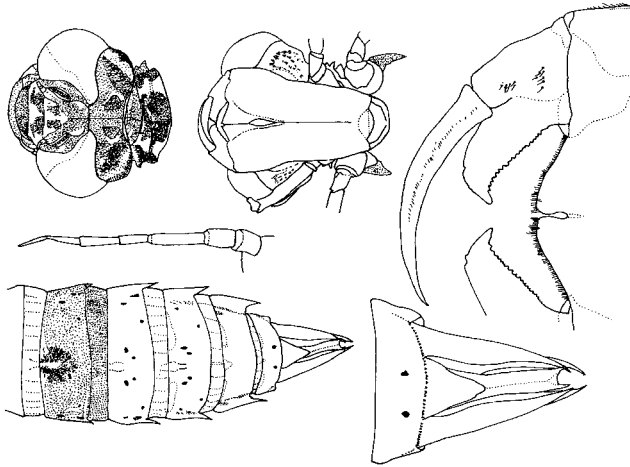


Fig. 3.2.510 *Castoraeschna tepuica* male larva: head in dorsal (upper left) and ventral view (upper center), antenna (middle left), apical segments of the abdomen in dorsal view showing the pattern in detail only on the sixth segment (lower left), tenth abdominal segment with appendages in dorsal view (lower right), and the anterior part of the labium in dorsal view showing one complete palp and the anterior margin of the prementum (upper right). Based on DeMarmels (1990a).

2. The abdominal segments are patterned with broad dark areas along the midline, which form a broad mid-dorsal band continuing to the tenth segment. There is another dorsolateral dark area containing pale markings that reaches the ninth segment. Between the dark areas, the tergites are pale with small, round dark markings. There is a small tubercle on each side of the median cleft along the anterior margin of the prementum (**Fig. 3.2.443**).

.....*Castoraeschna decurvata* Dunkle and Cook, 1984 (Argentina).

- The median dark stripe on the abdomen is very narrow, only 2.0 to 2.2 mm across and obviously interrupted at the junctions of the segments. The abdomen is otherwise ochraceous with small dark markings arranged symmetrically on either side of the dorsal midline. Apparently, there is no tubercle on the anterior margin of the prementum near the median cleft, but the description is not detailed enough to determine that with certainty. Total length of final instar: 42 to 44 mm.

.....*Castoraeschna castor* (Brauer, 1865) (Argentina, Surinam?, Espirito Santo, Minas Gerais, São Paulo, Rio de Janeiro). Syn: *Aeshna castor* Brauer, 1865.

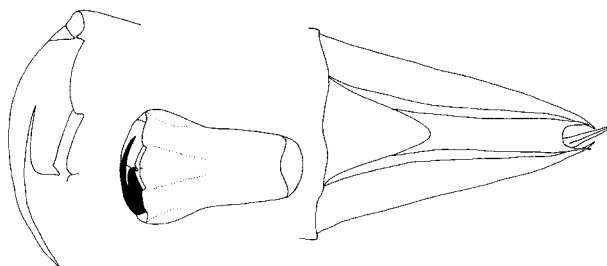


Fig. 3.2.511 *Castoraeschna castor* larva (left to right): a labial palp in ventral view, the entire labium in ventral view, and the caudal appendages in dorsal view. Based on Santos (1970d).

Key to the species of adult *Coryphaeschna* in South America

Information for the key was provided by Calvert (1956), Paulson (1994), and Tennesen (2001).

1. The fourth through tenth abdominal segments have a distinctive brown or black and green pattern.2
 - The fourth through tenth abdominal segments are mainly red and lack a distinctive brown and green pattern.3
 2. The inferior anal appendage of the male reaches to from 36% to 40% of the length of the superior appendages (**Fig. 3.2.512**). The face of the male is bright blue; that of the female is green. The black T-spot on the frons extends onto the anterior surface and fills the curved transverse groove on the dorsal side (except in some Mexican specimens). Total length of male: 65 mm; female: 70 mm. Length of male abdomen without anal appendages: 43 to 48 mm; female: 46 to 52 mm. Length of superior anal appendages of male: 5.2 to 6.4 mm; female: 6.3 to 7.4 mm. Hind wing length of male: 40 to 43 mm; female: 41 to 45 mm. Pterostigma length along costal vein of male: 3.6 to 4.2 mm; female: 3.7 to 4.5 mm. Color: the pronotum is dark yellowish red; propleura pale yellow; synthorax green with brown markings; fore-femur blue on underside; legs otherwise reddish brown near bases with black tibiae and tarsi; abdomen dark yellowish red to nearly black with pale green markings; wings clear or slightly smoky with brown veins and a pale brown costal vein; pterostigma blood red, burnt sienna, or pale brown dorsally and brown ochre or pale brown ventrally.*Coryphaeschna adnexa* (Hagen, 1861)
- (North and Central America, West Indies, Colombia, Ecuador, Peru, Venezuela, French Guiana, Surinam, Argentina, Paraguay, Rio de Janeiro, Amazonas, Mato Grosso, Mato Grosso do Sul). Syn: *Aeshna adnexa* Hagen, 1861; *Aeshna cyanifrons* Hagen, 1861 (*nomen nudum*); *Coryphaeschna guyanensis* Machet, 1991; *Aeshna macromia* Brauer, 1865.

- The inferior anal appendage of the male usually reaches to about 60% of the length of the superior appendage. The dark spot on the mesepisternum of the female is convex on its outer margin (**Fig. 3.2.513**). The face is bright green. The superior curved transverse groove on the anterior surface of the frons is usually not black or dark brown. Total length of male: c. 80 mm; female: c. 83 mm. Length of male abdomen: 50 to 57 mm; female: 51 to 65 mm. Superior anal appendages of the male: 5.4 to 6.7 mm; female: 4.9 to 8.9 mm. Hind wing length of male: 50 to 56 mm; female: 50 to 61.5 mm. Pterostigma length along the costal vein of the male: 4.3 to 5.5 mm; female: 4.3 to 5.7 mm.

.....*Coryphaeschna viriditas* Calvert, 1952
(North and Central America, West Indies, Colombia, Venezuela, French Guiana, Guyana, Surinam, Ecuador, Peru, Bolivia, Paraguay, Amazonas?, Mato Grosso).
Syn: *Aeshna virens* Rambur, 1842, nec Charpentier, 1840. A North American species, *Coryphaeschna ingens* (Rambur, 1842), will also key out here, but the male differs from *C. viriditas* in having wide brown stripes rather than narrow ones on the thoracic sutures and an inferior anal appendage usually reaching only to about 50% of the length of the superior appendage.

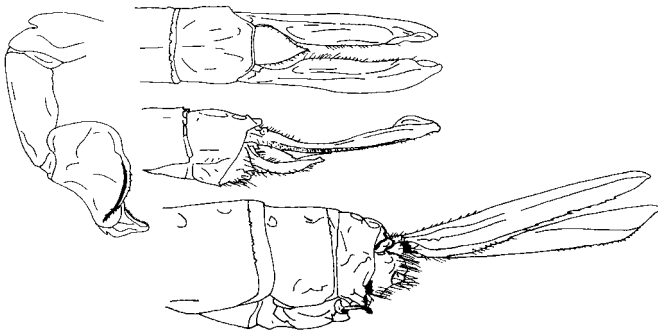


Fig. 3.2.512 *Coryphaeschna adnexa*: penis in lateral view (left), apex of the male abdomen in dorsal (upper right) and lateral view (middle right), and the apex of the abdomen of a female in lateral view (lower right). Based on Machet (1991).

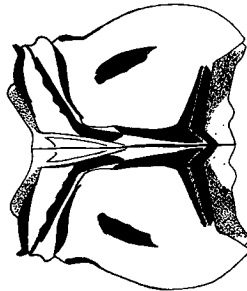


Fig. 3.2.513 The markings on the mesepisternum of a female *Coryphaeschna viriditas*. Based on Machet (1991).

3. The thorax is mainly green with brown on the middorsal carina, mesepisternum, and the mesopleural and metapleural sutures. The frons is reddish with no brown markings on its dorsal surface. The costa is reddish tan. The length of the inferior anal appendage reaches 47% to 50% of the length of the superior appendage (**Fig. 3.2.429**).

.....*Coryphaeschna huaorania* Tennessen, 2001
(Ecuador).

- The dorsal surface of the thorax is red, and its lateral surfaces are reddish with a green tinge, or the thorax of younger specimens may sometimes be green. In any case, there are no brown markings on the lateral and middorsal sutures (**Fig. 3.2.514**).4

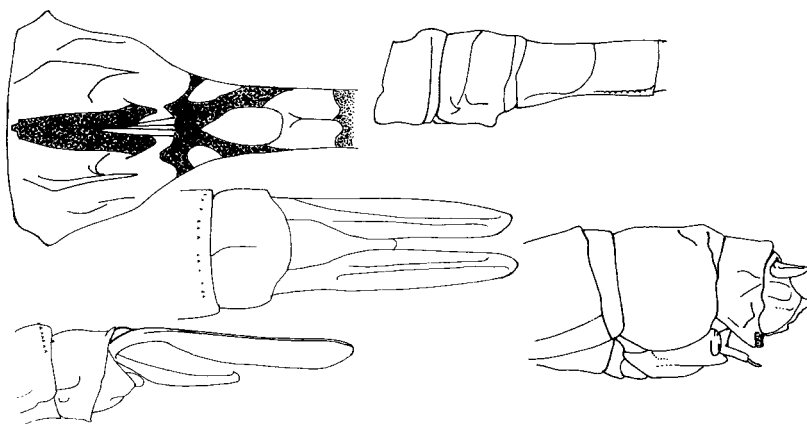


Fig. 3.2.514 *Coryphaeschna diapyra*: base of the male abdomen in ventral view showing the hamular processes (upper left) and in lateral view (upper right), apex of the male abdomen in dorsal (center) and lateral view (lower left), and the apex of the female abdomen in lateral view (lower right). Based on Paulson (1994)

4. The costal vein is entirely dark brown as far as the pterostigma. The tibiae and tarsi are mainly reddish tan, sometimes with dark red markings. The thorax is red laterally. The dorsal process of the penis, which is visible in ventral view, appears to be elevated above the segment by its median connection. The spiny patches diverge and become far apart apically. The apices of the penis are not visible in ventral view (**Fig. 3.2.514**).

.....*Coryphaeschna diapyra*, Paulson, 1994
(Central America, Ecuador, Venezuela).

- The costal vein is light reddish tan as far as the nodus but may become darker toward the pterostigma. The tibiae and tarsi are dark brown or black, sometimes with dark red markings. The thorax has a greenish tinge. In ventral view, the hamular processes are elongated and narrow (**Fig. 3.2.515**).5

5. From the nodus to the apex of the wing, vein R_1 is the same color as veins C and M_1 . In the fore-wing, the triangle is 6.4 to 6.9 mm long. The dorsal process of the penis, which is not visible in ventral view, is not at all elevated; the spiny patches, which are short and wide, are parallel or convergent. In ventral view, the hamular processes narrow to form an acute tip, with the apical extensions being about twice as long as the quadrilateral bases (**Fig. 3.2.515**). The entire body is dull reddish with greenish to grayish areas on the synthorax and sometimes on the first four abdominal segments.

.....*Coryphaeschna amazonica* DeMarmels, 1989
(Central America, Peru, Venezuela, French Guiana, Surinam, Brazil).

- From the nodus to the apex of the wing, vein R_1 is much darker than veins C and M_1 . In the fore-wing, the triangle is 5.8 to 6.2 mm long. The frons lacks a black T-shaped spot on the dorsal side. The face, thorax, and abdomen are mainly reddish. The inferior appendage of the male reaches to the mid-length of the superior appendages. The dorsal process of the penis folds so that the spiny patches are oriented perpendicular to the segment surface and close and parallel to each other (**Fig. 3.2.516**).

.....*Coryphaeschna perrensi* (McLachlan, 1887)
(Mexico, Central America, Venezuela, Peru, Paraguay, Argentina, Uruguay, Minas Gerais, Paraná, São Paulo, Rio de Janeiro, Santa Catarina, Rio Grande do Sul, Mato Grosso do Sul). Syn: *Aeshna perrensi* McLachlan, 1887; *Aeshna rufina* Hagen, 1875 (*nomen nudum*).

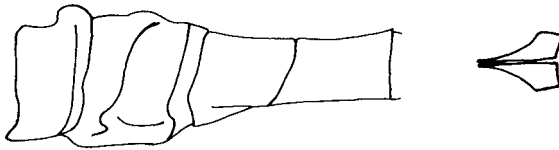


Fig. 3.2.515 *Coryphaeschna amazonica* male: basal segments of the abdomen in lateral view (left) and ventral view of the hamular process (right). Based on Paulson (1994).



Fig. 3.2.516 The apical segment of the penis of *Coryphaeschna perrensi* in ventral (left) and lateral view (right). Based on Tennessen (2001).

Key to the species of known *Coryphaeschna* larvae in South America

Information for the key was provided by Geijskes (1943), Santos (1969c, 1970e), and Carvalho (1992b). The key is rudimentary because the larvae of most species have not been described.

1. The labium is not notably elongated, being much less than twice as long as its maximum width. The prominences at either side of the median cleft in the

prementum bear only small tubercles. The epiproct is not the longest caudal appendage, and its lateral edges are rounded (**Fig. 3.2.517**).

.....*Coryphaeschna adnexa* (Hagen, 1861)
(North and Central America, West Indies, Colombia, Ecuador, Peru, Venezuela, French Guiana, Surinam, Argentina, Paraguay, Rio de Janeiro, Amazonas, Mato Grosso, Mato Grosso do Sul). Syn: *Aeshna adnexa* Hagen, 1861; *Aeshna cyanifrons* Hagen, 1861 (*nomen nudum*); *Coryphaeschna guyanensis* Machet, 1991; *Aeshna macromia* Brauer, 1865.

- The labium is elongated, being at least twice as long as its maximum width. The prominences on either side of the median cleft are large and spine-like (**Fig. 3.2.518**).2

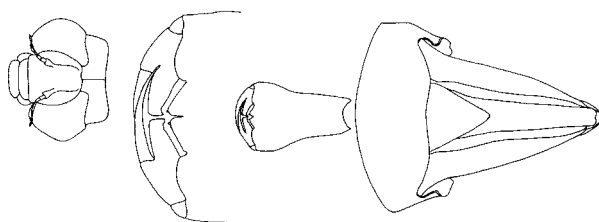


Fig. 3.2.517 *Coryphaeschna adnexa* male larva (left to right): head in dorsal view, labial palps and anterior margin of prementum, labium in ventral view, and the apex of the abdomen in dorsal view. Based on Santos (1970e).

2. The spine-like processes on either side of the median cleft in the anterior margin of the prementum are blunt at the apex and shorter than the depth of the cleft. The sides of the cleft are approximately parallel. The epiproct is the longest of the caudal appendages, at least as long as the cerci and paraprocts (**Fig. 3.2.518**).

.....*Coryphaeschna perrensi* (McLachlan, 1887)
(Mexico, Central America, Venezuela, Peru, Paraguay, Argentina, Uruguay, Minas Gerais, Paraná, São Paulo, Rio de Janeiro, Santa Catarina, Rio Grande do Sul, Mato Grosso do Sul). Syn: *Aeshna perrensi* McLachlan, 1887; *Aeshna rufina* Hagen, 1875 (*nomen nudum*).

- The spine-like processes on either side of the median cleft in the anterior margin of the prementum are longer than the depth of the cleft and acute at the apex. The internal part of the cleft is broadened. The epiproct is slightly shorter than the paraprocts. The pattern on the abdomen forms three broad, dark longitudinal stripes, the middle one poorly defined and divided in places by pale areas. There are usually two dark bands on the fore and middle femora, and one dark band on the hind femur (**Fig. 3.2.440**).

.....*Coryphaeschna viriditas* Calvert, 1952
(North and Central America, West Indies, Colombia, Venezuela, French Guiana, Guyana, Surinam, Ecuador, Peru, Bolivia, Paraguay, Amazonas?, Mato Grosso). Syn: *Ashna virens* Rambur, 1842, nec Charpentier, 1840.

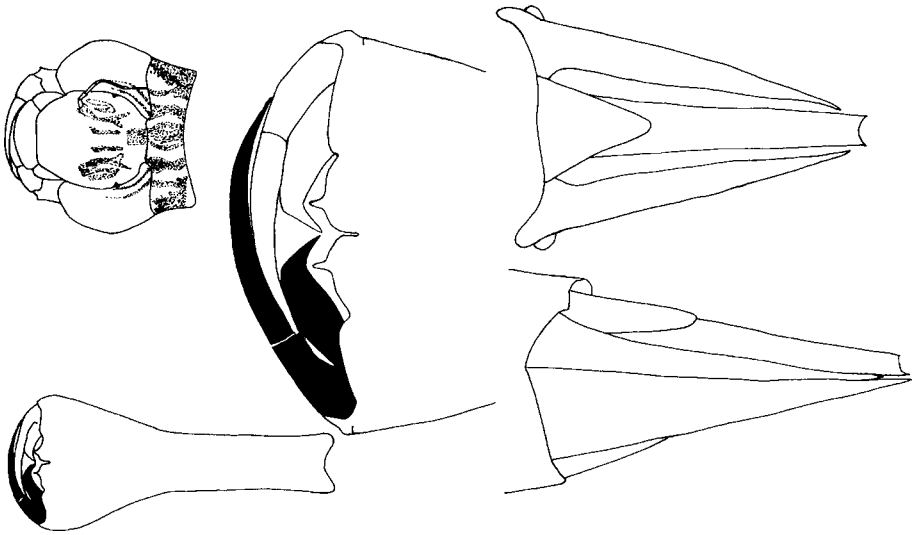


Fig. 3.2.518 *Coryphaeschna perrensi* larva: head in dorsal view (upper left), labial palps and anterior margin of prementum (upper center), labium in ventral view (lower left), and the apex of the abdomen in dorsal (upper right) and lateral view (lower right). Based on Santos (1969c).

Key to the species of adult *Remartinia* in South America

Information for the key was provided by Kennedy (1941) and Carvalho (1992a). No larvae from South America in this genus have been described.

1. The fork in vein IR_3 is asymmetrical. There is an excision on the internal margin of the blade of the superior anal appendage of the male. In dorsal view, a swollen process is visible on the dorsal side at the base of the inferior anal appendage of the male. There are six cells present between veins IR_3 and R_{spl} (Fig. 3.2.11). Total length of the male: 71.5 to 72 mm. Hind wing length of the male: 45 mm. Length of the margin of the pterostigma: 5.2 to 5.4 mm. Length of male abdomen without appendages: 47.5 to 48 mm. Color: yellowish brown labium, yellowish green labrum and postclypeus, olive anteclypeus, grayish blue frons with a black T-spot; reddish brown thorax with green stripes; reddish brown abdomen with black, green and yellow markings. The female has not been described.

.....*Remartinia restricta* Carvalho, 1992
(São Paulo).

- The fork in vein IR_3 is symmetrical (**Fig. 3.2.519**). There is an excision on the internal margin of the blade of the male superior anal appendage. In dorsal view, a swollen process is visible on the dorsal side at the base of the inferior anal appendage.2

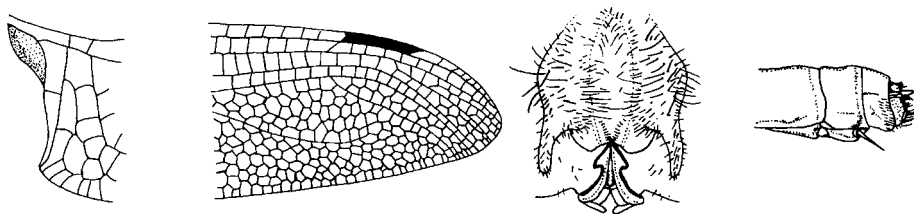


Fig. 3.2.519 *Remartinia luteipennis* (left to right): base of the hind wing and apex of the fore-wing of a male, hamular processes and anterior lamina of the male genitalia on the second abdominal segment in ventral view, and the apex of the abdomen of a female in lateral view. Based on Carvalho (1992a).

2. There is a deep excision at $3/4$ of the length of the superior appendage of the male on the mesal margin; in lateral view, the apex of this appendage is obliquely truncate. In dorsal view looking slightly toward the head, the superior anal appendages appear rounded. The anal appendages of the female are not divided but very short: 1.5 mm in length (**Fig. 3.2.519**).

..... *Remartinia luteipennis* (Burmeister, 1839) (North and Central America, Colombia, Venezuela, Argentina, Paraguay, Mato Grosso, Minas Gerais, São Paulo, Rio de Janeiro, Paraná, Santa Catarina, Rio Grande do Sul). Syn: *Remartinia barbiellina* Navás, 1911; *Aeschna excisa* Brauer, 1865; *Coryphaeschna luteipennis* (Burmeister, 1839). There are two subspecies found only in North America (Calvert, 1956): *R. luteipennis peninsularis* (Calvert, 1941), and *R. l. florida* (Hagen, 1961).

- There is a deep excision at $2/3$ of the length of the superior appendage of the male on the mesal margin; in lateral view, the apex of this appendage tapers to a rather acute point that is bent ventrad. The anal appendages of the female are not divided but very short: sometimes less than 1 mm in length (**Fig. 3.2.430**). The superior anal appendage of the male is 5.9 to 6.1 mm long. Total length of male: c. 74 mm. Length of male abdomen: 47 to 53 mm; female: c. 61 mm. Hind wing length of male: 43 to 46 mm; female: c. 51 mm. Pterostigma on the fore-wing of the male: 3.2 to 3.6 mm; female: 3.7 to 3.8 mm. Color: the face of the male is pale blue with a brown line on the frontoclypeal suture, and that of the female is brown with an olive tint. The eyes of the male are olive green dorsally and bluish green ventrally. The male prothorax is blackish with a pale blue hind margin. The synthorax has a moderate covering of pale hairs. The antehumeral stripe is bright green, and the mid-dorsal antealar stripe is dark brown. The ventral side of the fore-femur is blue, and the other femora are reddish brown at

their bases. The tarsi are black, and the rest of the legs are blackish brown. The anterior part of the abdomen is mainly dark brown, and its posterior part is mainly black; its markings are green. The wings are smoky. The pterostigma is reddish brown, and the membranule is cinereous.

.....*Remartinia rufipennis* (Kennedy, 1941)
(Ecuador, Peru). Syn: *Aeshna rufipennis* Kennedy, 1941.

Key to the species of adult *Gynacantha* in South America

Information for the key was provided by Williamson (1923b), Navás (1934), and Paulson and von Ellenrieder (2005).

1. The superior anal appendage of the male is much longer than double the length of the inferior appendage, and its apex is greatly broadened into a nearly round or elliptical plate, best seen in dorsal view. The apex of the inferior appendage is indented slightly (**Fig. 3.2.520**).

.....*Gynacantha chelifera* McLachlan, 1896
(Brazil). Syn: *Selysiophlebia aratrix* Foerster, 1905.

- The superior anal appendage is broadened slightly far proximal to the apex, or, if enlarged at the apex, the enlargement is truncate or flat on one side. If the apex of the superior appendage is enlarged, then the inferior anal appendage is more than half as long as the superior appendage and rounded at the apex without any trace of an indentation (**Fig. 3.2.521**).2

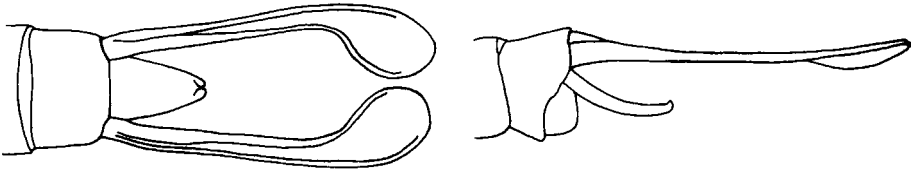


Fig. 3.2.520 The apex of the abdomen of a male *Gynacantha chelifera* in dorsal (left) and lateral view (right). Based on Williamson (1923b).

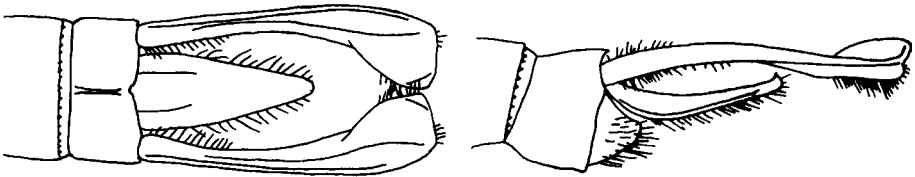


Fig. 3.2.521 The apex of the abdomen of a male *Gynacantha adela* in dorsal (left) and lateral view (right). Based on Williamson (1923b).

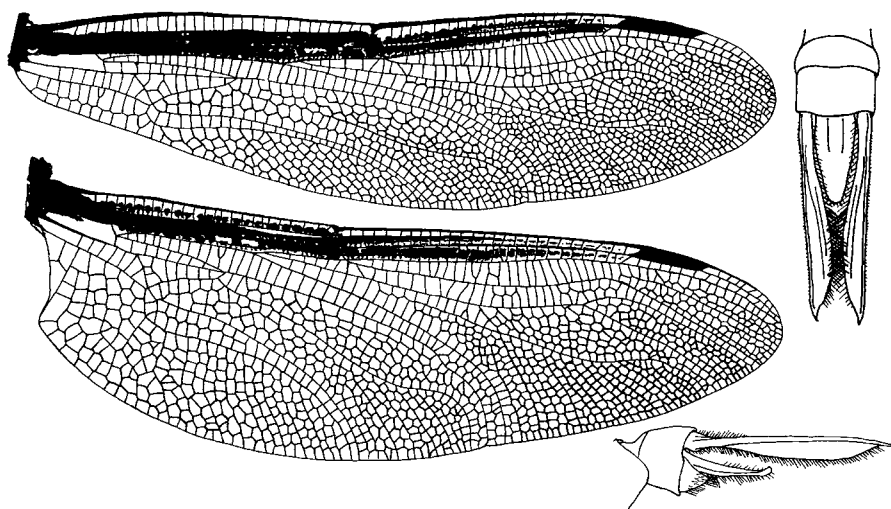


Fig. 3.2.522 *Gynacantha gracilis* male: fore and hind wing (left) and the apex of the abdomen in dorsal (upper right) and lateral view (lower right). Based on Williamson (1923b).

2. One or more antenodal cross veins of the second series and rarely some of the first series basal to the first thickened antenodal are present on either the fore or hind wings or both. There are two rows of cells between veins M_3 and M_4 just beyond the loop in M_4 . The abdomen and hind wing are at least 55 mm in length. The pterostigma on the fore-wing is at least 5 mm long. The colors are bright and contrasting. The basal area of the wing is colored with the pattern extending nearly to the first antenodal or beyond. The abdomen is greatly enlarged at the base and constricted at the third segment, and its length is at least about 55 mm long. The ventral carina on the second abdominal segment of the male is concave as far posteriorly as the convergence, where it meets the lateral carina at an acute angle. The spines on the anterior lamina are directed caudoventrad (**Fig. 3.2.522**). The species fly throughout the day.3

- There are no antenodal cross veins in either the first or second series proximal to the first thickened antenodal, but rarely a single vein may develop on one of the wings. If the length of the abdomen is less than about 51 mm long and the hind wing, less than about 48 mm, it belongs here (**Fig. 3.2.523**).4

3. The colored area of the wing base occupies less than half of the median space and is bounded posteriorly by A. The T-shaped spot on the frons is prominent. The ventral carina on the second segment of the male with no more than a few teeth anterior to the point of convergence and a few teeth posterior to it. There are seven or eight denticles on the auricle (**Fig. 3.2.522**). Length of abdomen of male: 60 to 62 mm; female; 58 to 62 mm. Hind wing length of male: 57 to 62 mm; female: 57 to 63 mm. The body is dull reddish brown with blackish areas

on the posterior half of the first eight abdominal segments. The pterostigma is orange brown. The legs are reddish with narrowly dark knees.

.....*Gynacantha gracilis* (Burmeister, 1839)
(Central America, Ecuador, Peru, Venezuela, Guyana, French Guiana, Surinam, Bolivia, Argentina, Amazonas, Rio de Janeiro). Syn: *Aeshna gracilis* Burmeister, 1839.

- The colored area of the wing occupies all or nearly all of the median space and extends posteriad beyond A, especially in the hind wing. The frons is black or darkened without any T-shaped spot. The ventral carina on the second segment of the male with a row or ten or more teeth anterior to the point of convergence and no teeth posterior to it. There are only three or four denticles on the auricle (**Fig. 3.2.427**). Length of abdomen of male: 55 to 63 mm; female: 61.5 to 65 mm. Hind wing length of male: 55 to 60 mm; female: 59 to 64 mm. The body is dull reddish brown with narrow blackish areas on the posterior margins of all abdominal segments. The pterostigma is orange. The legs are reddish with dark knees.

.....*Gynacantha membranalis* Karsch, 1891
(Central America, Colombia, Ecuador, Peru, Venezuela, Bolivia, Guyana, French Guiana, Surinam, Pará). Syn: *Gynacantha jubilaris* Navás, 1915.

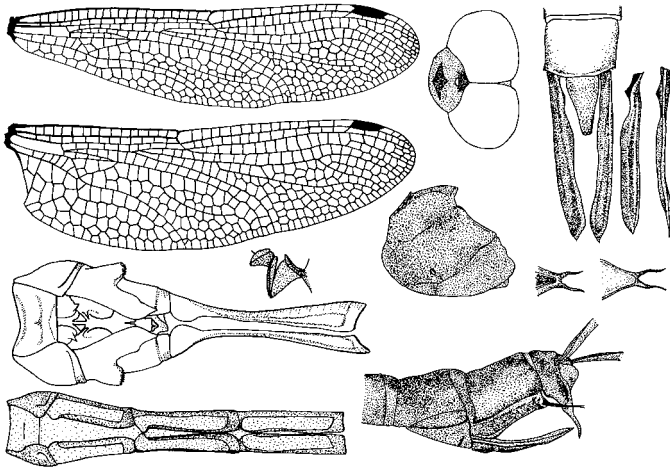


Fig. 3.2.523 *Gynacantha bartai*: fore and hind wing of a male (upper left), ventral view of the first three abdominal segments of a male with an enlarged hamulus above it (lower middle left) and the same view of a female (lower left), head of a male with the T-spot in dorsal view (upper right center), male synthorax in lateral view (center), apex of a male abdomen in dorsal view with the superior anal appendage in mediiodorsal and lateral view (upper right, left to right), two spined processes from the ventral part of the tenth abdominal segments of two specimens (lower middle right), and apex of a female abdomen in lateral view (lower right). Based on Paulson and von Ellenrieder (2005).

4. The hind wing is no more than about 38 mm long, and the anal loop in the hind wing has a maximum of 8 cells. The third abdominal segment of the male is obviously constricted (**Fig. 3.2.523**).5

- The hind wing of most species is longer than 38 mm, and those species with shorter hind wings have more than 8 cells in the anal loop of the hind wing, and the third abdominal segment of the male is not obviously constricted (**Fig. 3.2.524**).6

5. The color pattern on the thorax is uniform brown. The anal loop consists of 5 to 8 cells. There are two rows of cells between the anal loop and the posterior margin of the wing (**Fig. 3.2.523**). The third abdominal segment of the female is not notably constricted. Total length: 45 to 47 mm. Length of abdomen without appendages: 34 to 35 mm. Hind wing length: 32 to 33 mm.

.....*Gynacantha bartai* Paulson and von Ellenrieder, 2005 (Peru).

- The thorax has a pattern of stripes. The anal loop consists of only 4 or 5 cells. There is one row of cells between the anal loop and the posterior margin of the wing. The third abdominal segments of both males and females are notably constricted. Hind wing length: 36 to 38 mm.

.....*Gynacantha francesca* (Martin, 1909) (French Guiana, Surinam). Syn: *Subaeschna francesca* Martin, 1909.

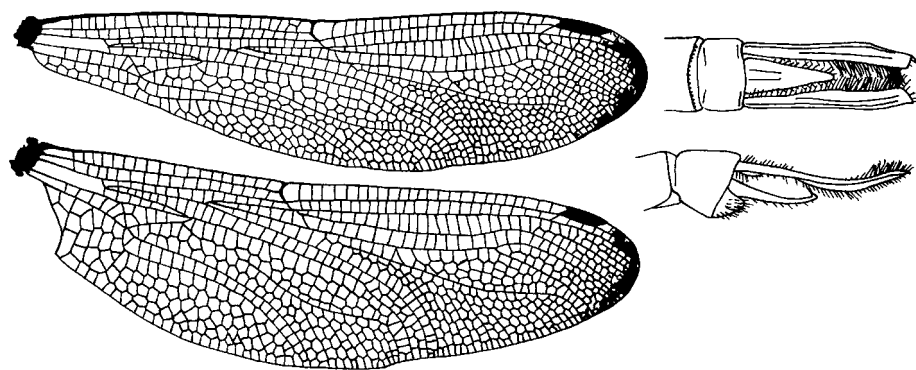


Fig. 3.2.524 *Gynacantha tenuis* male: fore and hind wing (left) and the apex of the abdomen in dorsal (upper right) and lateral view (lower right). Based on Williamson (1923b).

6. The abdomen of the male is usually constricted at the third segment, and the ventral carina on the second abdominal segment is concave posterior to the point of convergence and meets the lateral carina at an acute angle. If the pterostigma on the fore-wing is longer than about 4 mm, then the auricles of the male are very large or there is a median apical tubercle on the first abdominal sternite in both sexes (**Fig. 3.2.524**).7

- The ventral carina on the second abdominal segment is straight or convex and never concave posterior to the point of convergence; it meets the lateral carina at a rounded angle. If the pterostigma is longer than about 4 mm, and the auricles of the male are never large or there is never a median apical tubercle on the first abdominal sternite of both sexes, the specimen belongs here. The coloring is dull, usually brown, or if green is present, it is dull green. The thorax is brown with at least four black spots. The legs are pale in color. The venation of the wing is always complex (**Fig. 3.2.525**). The adults fly during the evening or in woods during the day.16
- 7. The legs are black or black and yellow, with the bases of the femora somewhat pale.8
- The legs are pale yellowish or reddish.10

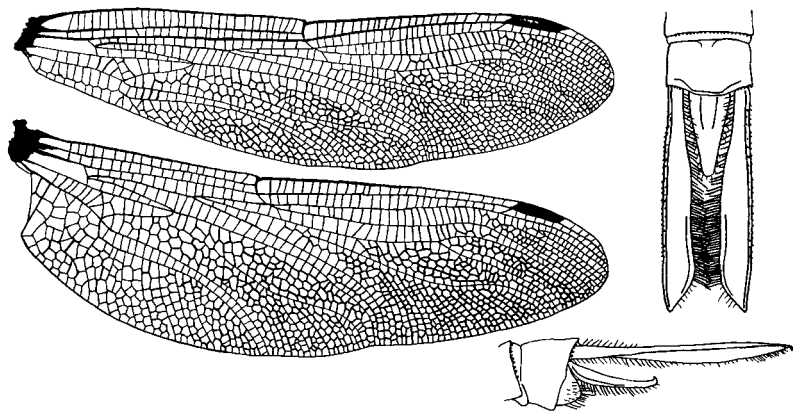


Fig. 3.2.525 *Gynacantha mexicana* male: fore and hind wing (left) and the apex of the abdomen in dorsal (upper right) and lateral view (lower right). Based on Williamson (1923b).



Fig. 3.2.526 *Gynacantha jessei* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Williamson (1923b).

8. The abdominal appendages of the male are black. The tarsi of the middle and hind legs are all black or show only a trace of yellow. The first abdominal sternite bears no tubercle. There are low ridges on the dorsal surface near the apex of the superior anal appendages (**Fig. 3.2.526**). Length of abdomen of male: 47 mm. Hind wing length of male: 43 mm. Female not described.
.....*Gynacantha jessei* Williamson, 1923
(Central America, Colombia).

- The apical abdominal appendages of the male are yellow (**Fig. 3.2.527**).9
 9. The inferior anal appendage of the male, in dorsal or ventral view, appears truncate or slightly concave at the apex (**Fig. 3.2.527**). The tarsi of the middle and hind legs are striped yellow dorsally. The first abdominal sternite has a low, median, posterior tubercle. The apical abdominal appendages of the male are yellow or yellowish. Length of abdomen of male: 41 to 50 mm; female: 51 to 53.5 mm. Hind wing length of male: 41 to 50 mm; female: 50 to 53 mm.

.....*Gynacantha tibiata* Karsch, 1891
 (Mexico, Central America, Venezuela, Ecuador, Peru).

- The inferior anal appendage of the male, in dorsal or ventral view, appears evenly and broadly rounded at the apex (**Fig. 3.2.528**). The legs of the male are black with the middle tibia yellow dorsally, and the basal 2/3 of the hind tibia, ferrugineous. The legs of the female are yellowish green with black spines. Total length of male: c. 68 mm; female: c. 57 mm. Length of male abdomen: c. 50 mm; female: c. 43 mm. Hind wing length of male: 47 mm; female: 43 mm. The thorax is mainly olive green, and the abdomen is mainly greenish, or greenish yellow in the male, with darkened margins of the segments. The species has been inadequately described for a positive identification, and it may be conspecific with *G. tibiata*. Better descriptions and lectotypes of the male and female are urgently needed.

.....*Gynacantha remartinia* Navás, 1934
 (Colombia).

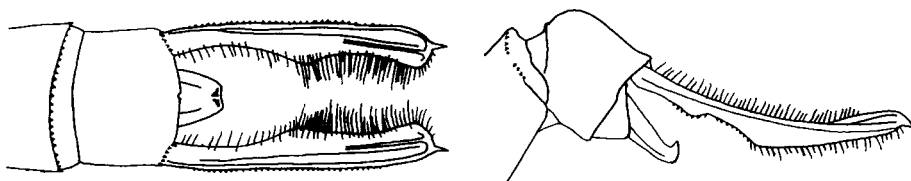


Fig. 3.2.527 *Gynacantha tibiata* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Williamson (1923b).

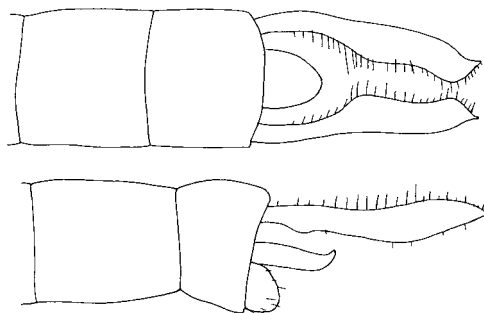


Fig. 3.2.528 *Gynacantha remartinia* male: apex of the abdomen in dorsal (above) and lateral view (below). Based on Navás (1934).

10. There is a distinct brown stripe along the first lateral suture. The anal loop is separated from the posterior margin of the wing by a single row of cells (**Fig. 3.2.524**).11

- There is no brown stripe running along the first lateral suture. The anal loop is usually separated from the posterior margin of the wing by two or three rows of cells.12

11. The male usually has a row of small scale-like teeth on the ventral carina of the second abdominal segment anterior to its point of convergence. The lateral carina on that segment is black or dark brown posterior to the apex of the auricle. The lateral and ventral carinae on the third abdominal segment of the female are very slightly convergent just anterior to the level of the transverse carina. The apex of the inferior anal appendage is pointed dorsad, as seen in lateral view (**Fig. 3.2.524**). Length of male abdomen: 38.5 to 44 mm; female: 41 to 47 mm. Hind wing length of male: 39 to 41.5 mm; female: 38 to 46 mm. The legs are amber. The thorax is reddish brown, and the abdomen is dark reddish brown. The wings have an amber tinge, and the pterostigma is dark brown.

.....*Gynacantha tenuis* Martin, 1909
(Trinidad, Colombia, Ecuador, Peru, Venezuela, French Guiana, Guyana, Surinam, Brazil).

- The male lacks teeth on the ventral carina of the second abdominal segment. The lateral carina on that segment is pale posterior to the apex of the auricle. The apices of the superior appendages are acute at the outer angles (**Fig. 3.2.529**). Length of abdomen of male: 40 to 41 mm. Hind wing length of male: 40 to 41 mm. The female has not been described.

.....*Gynacantha caudata* Karsch, 1891
(Central America, Ecuador).



Fig. 3.2.529 The apex of the abdomen of a male *Gynacantha caudata* in dorsal (left) and lateral view (right). Based on Williamson (1923b).

12. The hind wing length is 45 mm or longer. The auricles of the male are expanded and very large, extending caudad in lateral view far beyond the level of the mid-length of the transverse carina. The spines on the anterior lamella are not directed more ventrad than caudad. The lateral and ventral carinae on the second abdominal segment of the female diverge anteriorly, and the abdominal appendages are shorter than the last two segments (**Fig. 3.2.530**).13

- The hind wing length is shorter than 45 mm (**Fig. 3.2.531**). The auricles of the male do not extend as far caudad as the level of the mid-length of the transverse carina. The lateral and ventral carinae on the second abdominal segment of the female are nearly parallel.14

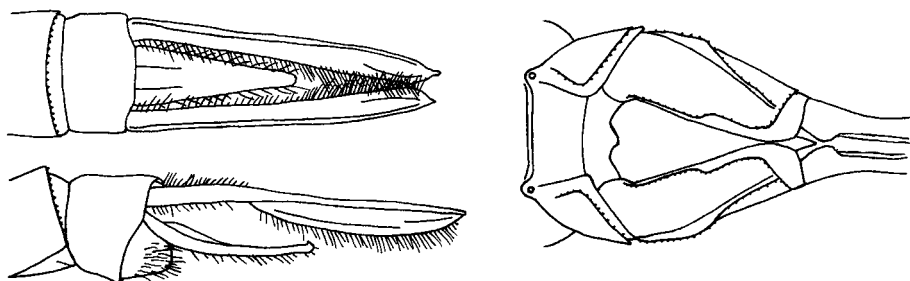


Fig. 3.2.530 The apex of the abdomen of a male *Gynacantha klagesi* in dorsal (upper left) and lateral view (lower left) and the second and base of the third abdominal segment of a female in ventral view (right). Based on Williamson (1923b).

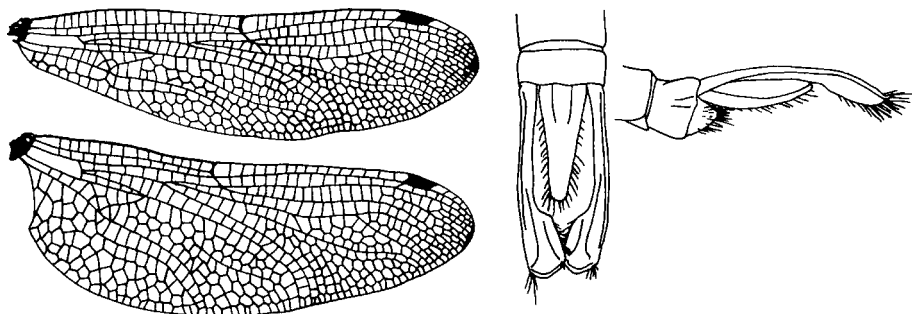


Fig. 3.2.531 *Gynacantha laticeps* male: fore and hind wing (left) and the apex of the abdomen in dorsal (center) and lateral view (right). Based on Williamson (1923b).

13. The auricles of the males are not brilliantly colored ventrally, and the black edge is not produced anteriorly on the venter to the level of the hamular process. There are no teeth on the ventral carina of the second abdominal segment. The abdomen of the female is not constricted at the third abdominal segment, and the lateral carina on the second abdominal segment is uniformly low for its whole length (**Fig. 3.2.532**). Length of male abdomen: 50 to 52 mm; female; 51 to 55

mm. Hind wing length of male: 49 to 51 mm; female: 51 to 54 mm. The body is dull reddish brown with a few lighter and darker markings. The pterostigma is reddish brown.

.....*Gynacantha auricularis* Martin, 1909
(Central America, Ecuador, Peru, Bolivia, Venezuela, French Guiana, Guyana, Surinam, Pará, Mato Grosso). Syn: *Gynacantha subviridis* sensu Kirby, 1897.

- The auricles of the males are brilliantly colored ventrally, and the black edge is produced anteriorly on the venter to the level of the hamular process. There is a row of scale-like teeth on the ventral carina of the second abdominal segment anterior to the point of convergence. The abdomen of the female is constricted at the third abdominal segment, and the lateral carina on the second abdominal segment is elevated at the point where the auricle of the male would be (**Fig. 3.2.530**). Length of male abdomen: 47 to 49 mm; female: 50 mm. Hind wing length of male: 47 to 48 mm; female: 50 mm. The color is a nearly uniform reddish brown with narrow dark bands at the posterior margins of the first eight abdominal segments.

.....*Gynacantha klagesi* Williamson, 1923
(Peru, Venezuela, French Guiana, Surinam).

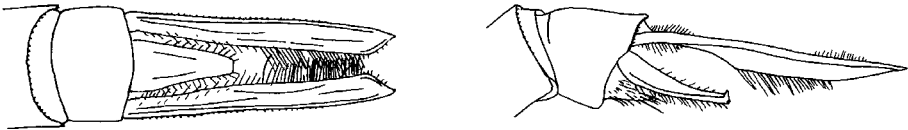


Fig. 3.2.532 *Gynacantha auricularis* male: apex of the abdomen in dorsal (left and lateral view (right). Based on Williamson (1923b).

14. The spines on the anterior lamina of the male are directed more caudad than ventrad. In the male, there are two cells between the anal loop and the anal triangle in the first row posterior to A. The wings are not brown spotted at the base, and the wing bases of the female are hyaline. In the wings of the female, there are four cells posterior to A and proximal to the anal loop. The apices of the superior anal appendages are greatly widened on the inner margins (**Fig. 3.2.521**). Length of male abdomen: 44 to 45 mm; female: 44 mm. Hind wing length of male: 42 to 43 mm; female: 43 mm.

.....*Gynacantha adela* Martin, 1909
(Peru, Bolivia, Argentina, Minas Gerais, São Paulo). Syn: *Gynacantha martini* Navás, 1911.

- The spines on the anterior lamina of the male are directed more ventrad than caudad. If the wings of the female are not hyaline at the base, or, if they are, then there are only three cells posterior to A and proximal to the anal loop (**Fig. 3.2.531**).15

15. The wing bases are hyaline. The abdomen of the male is not constricted at the third segment. The distance between the lateral and ventral carinae on the third abdominal segment of the female is not narrowed at the level of the transverse carina to as much as half of its width posterior to this point. In the male, there is only one cell between the anal loop and the anal triangle in the first row posterior to A. In the wings of the female, there are three cells posterior to A and proximal to the anal loop (**Fig. 3.2.531**). Length of abdomen of male: 33 to 33.5 mm; female: 35 to 38 mm. Hind wing length of male: 32 mm; of female: 34 to 37 mm.

.....*Gynacantha laticeps* Williamson, 1923
(Mexico, Central America, Venezuela, Minas Gerais).

- The wing bases are tinged brown nearly to or slightly beyond the first antenodal vein. The abdomen of the male is constricted at the third segment. The distance between the lateral and ventral carinae on the third abdominal segment of the female is narrowed at the level of the transverse carina to about half of its width posterior to this point. In the male, there are two cells between the anal loop and the anal triangle in the first row posterior to A. In the wings of the female, there are four cells posterior to A and proximal to the anal loop. The apex of the inferior appendage has a shallow impression (**Fig. 3.2.533**). Length of abdomen of male: 42 mm; of female: 44 to 45 mm. Hind wing length of male: 38 mm; of female: 41 to 41.5 mm.

.....*Gynacantha convergens* Förster, 1908
(Bolivia, Paraguay, Argentina). Syn: *Gynacantha limai* Navás, 1916.

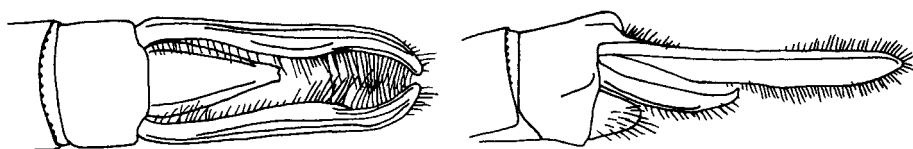


Fig. 3.2.533 The apex of the abdomen of a male *Gynacantha convergens* in dorsal (left) and lateral view (right). Based on Williamson (1923b).

16. A wide black stripe covers at least the posterior third of the mesepimeron. The wings are hyaline or have only a slight trace of color near the costal margin. The abdomen of the male is strongly constricted at the third abdominal segment. The lateral carina on the second segment of the female is distinctly black (**Fig. 3.2.525**). Length of abdomen of male: 49 to 52 mm; female: 47 to 50 mm. Hind wing length of male: 46 to 48 mm; of female: 47 to 50 mm. The color is mainly reddish brown, and the wing has amber veins and a dark yellow pterostigma. The superior anal appendage is dark.

.....*Gynacantha mexicana* Selys, 1869
(Mexico, Central America, Ecuador, Peru, Colombia, Venezuela, French Guiana, Surinam, Guyana, Bolivia, Pará).

- There is no distinct wide black stripe on the mesepimeron. The lateral carina on the second segment of the female is not distinctly black (**Fig. 3.2.534**).17
- 17. Males, with accessory genitalia on the ventral side of the second abdominal segment.18
- Females, without accessory genitalia.22
- 18. Viewed dorsally, the third abdominal segment is strongly constricted. The lateral and ventral carina are fused or in contact at the level of the transverse carina and for a short distance anterior to that point.19
- Viewed dorsally, the third abdominal segment is no more than slightly constricted. The lateral and ventral carinae are separated for their entire lengths (**Fig. 3.2.534**).20

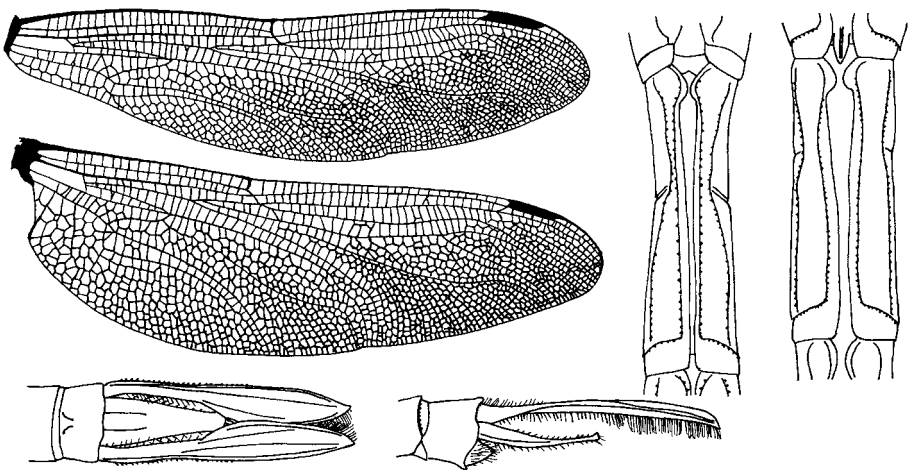


Fig. 3.2.534 *Gynacantha nervosa*: fore and hind wing (upper left), ventral view of the third abdominal segment of a male (right center) and female (right), and the apex of the male abdomen in dorsal (lower left) and lateral view (lower center). Based on Williamson (1923b).

19. There is a colored stripe along the costal margin, darker basally and becoming lighter apically (**Fig. 3.2.535**). Length of abdomen of male: 54 to 56 mm. Hind wing length of male: 51 to 52 mm. Male chromosome number: $2n = 26$, $n = 13$ (Ferreira *et al.*, 1979).

.....*Gynacantha interioris* Williamson, 1923 (Ecuador, Peru, Bolivia, Venezuela, French Guiana, Pará).

- There is no colored costal stripe on the wing. There are three rows of cells between the anal loop and the posterior margin of the wing (**Fig. 3.2.536**).

Length of abdomen of male: 50 to 53 mm. Hind wing length of male: 48 to 52 mm.

.....*Gynacantha litoralis* Williamson, 1923 (Peru, French Guiana, Surinam, Amazonas). A similar but smaller species, *Gynacantha ereagris* Gundlach, 1919, is known only from the Bahamas and Cuba. Its abdomen of the male is 43 to 44.5 mm, and its hind wing is no more than 43 mm long.

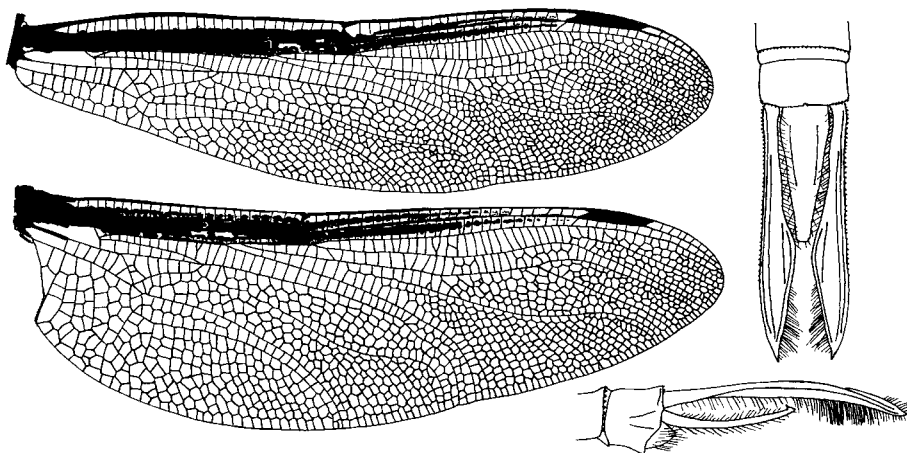


Fig. 3.2.535 *Gynacantha interioris* male: fore and hind wing (left) and the apex of the abdomen in dorsal (upper right) and lateral view (lower right). Based on Williamson (1923b).

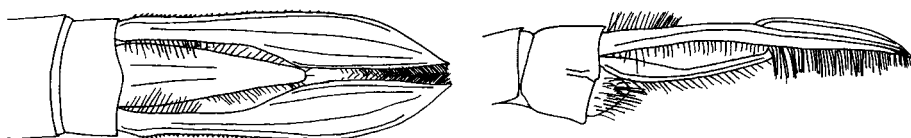


Fig. 3.2.536 *Gynacantha litoralis* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Williamson (1923b).

20. The wings are uniformly hyaline or brownish tinged. The lateral and ventral carinae on the third abdominal segment approach each other at the level of the transverse carina, but are distinctly separate and distinctly diverge anteriorly from this point (**Fig. 3.2.534**). Length of abdomen of male: 50 to 54 mm. Hind wing length of male: 47 to 54 mm. The ground color of the male is dark reddish brown, and the female is lighter reddish brown. The legs are reddish.

.....*Gynacantha nervosa* Rambur, 1842 (North and Central America, West Indies, Colombia, Ecuador, Peru, Venezuela, Guyana, French Guiana, Surinam, Bolivia, Mato Grosso).

- There is a distinct stripe of color along the costal margin. The lateral and ventral carinae on the third abdominal segment are widely separated throughout their length and only converge slightly anterior from this point (**Fig. 3.2.537**).

.....21
21. Only the costal area of the wing displays a contrasting color. The acute apices of the superior anal appendages diverge somewhat (**Fig. 3.2.537**). Length of abdomen of male: 51 to 52 mm. Hind wing length of male: 51 to 52 mm.

.....*Gynacantha bifida* Rambur, 1842
(Peru, Venezuela, Argentina, Paraguay, Minas Gerais, São Paulo, Rio de Janeiro, Santa Catarina). Syn: *Gynacantha robusta* Kolbe, 1888.

- The entire membrane of the wing is yellowish. The acute apices of the superior anal appendages are both directed posteriad (**Fig. 3.2.538**). Length of abdomen of male: 55 mm. Hind wing length of male: 54 mm.

.....*Gynacantha croceipennis* Martin, 1897
(Peru, Bolivia).

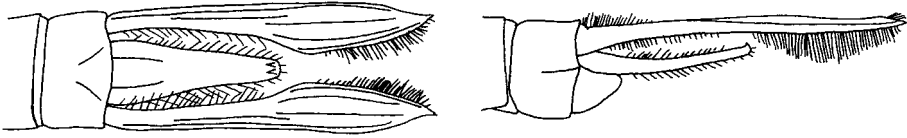


Fig. 3.2.537 *Gynacantha bifida* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Williamson (1923b).

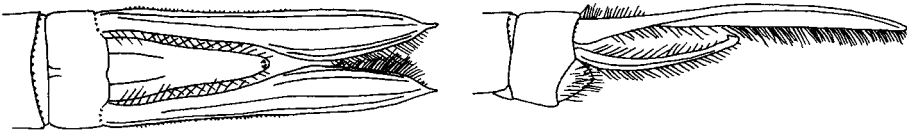


Fig. 3.2.538 *Gynacantha croceipennis* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Williamson (1923b).

22. The third abdominal segment is slightly constricted. The space between the ventral and lateral carinae is narrowed posterior to the level of the transverse carina to about half or less its maximum separation. Length of abdomen of female; 56 mm. Hind wing length of female: 55 mm.

.....*Gynacantha litoralis* Williamson, 1923
(Peru, French Guiana, Surinam, Amazonas). A similar but smaller species, *Gynacantha ereagris* Gundlach, 1919, is known only from the Bahamas and Cuba. Its abdomen and hind wing are each no more than 46 mm long.

- The third abdominal segment is not constricted. The space between the ventral and lateral carinae is no more than slightly narrowed posterior to the level of the transverse carina (**Fig. 3.2.534**).23
- 23. The wings are hyaline or uniformly tinged. Length of abdomen of female: 52.5 to 57 mm. Hind wing length of female: 52.5 to 56 mm.
.....*Gynacantha nervosa* Rambur, 1842
(North and Central America, West Indies, Colombia, Ecuador, Peru, Venezuela, Guyana, French Guiana, Surinam, Bolivia, Mato Grosso).
- The costal border of the wing is distinctly darkened (**Fig. 3.2.535**).24
- 24. The wing membrane is yellowish or brownish. The costal border extends as far posteriad as vein R. Length of female abdomen; 60 mm. Hind wing length of female: 57 mm.
.....*Gynacantha croceipennis* Martin, 1897
(Peru, Bolivia).
- The wings are hyaline except for the costal stripe (**Fig. 3.2.535**).25
- 25. The costal border is yellowish with a brownish basal section and extends as far posteriad as vein R. Length of abdomen of female: 53 to 54 mm. Hind wing length of female: 54 to 55 mm.
.....*Gynacantha bifida* Rambur, 1842
(Peru, Venezuela, Argentina, Paraguay, Minas Gerais, São Paulo, Rio de Janeiro, Santa Catarina). Syn: *Gynacantha robusta* Kolbe, 1888.
- The costal border is brown and extends posteriad as far as vein M (**Fig. 3.2.535**). Length of female abdomen: 54 to 57 mm. Hind wing length of female: 54 to 56 mm.
.....*Gynacantha interioris* Williamson, 1923
(Peru, Venezuela, French Guiana, Pará).

Key to the species of known *Gynacantha* larvae in South America

Information for the key was provided by Carvalho and Ferreira (1989).

1. The palpal setae are poorly developed. A pair of strong pointed teeth flanks the median cleft in the prementum. Retracted, the labium reaches posteriad to the hind coxae. The fifth through ninth abdominal segments bear lateral spines (**Fig. 3.2.438**). The color of the larva is uniform without a definite pattern.
.....*Gynacantha gracilis* (Burmeister, 1839)
(Central America, Ecuador, Peru, Venezuela, Guyana, French Guiana, Surinam, Bolivia, Argentina, Amazonas, Rio de Janeiro). Syn: *Aeshna gracilis* Burmeister, 1839.
- The distal palpal setae are moderately to well developed. The teeth that flank the median indentation in the prementum are small and inconspicuous. When the labium is retracted, it reaches only as far posteriad as the middle coxae. The sixth through ninth segments of the abdomen bear lateral spines (**Fig. 3.2.539**). The color pattern of the larva includes dark longitudinal stripes.2

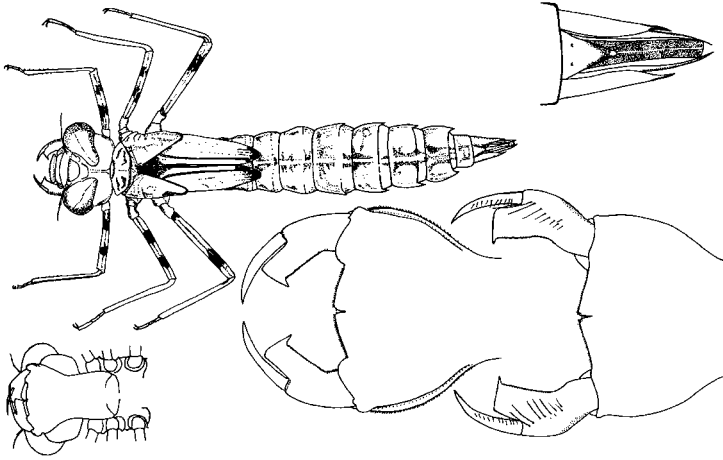


Fig. 3.2.539 *Gynacantha membranalis* larva: habitus (upper left), outline of head and thorax in ventral view showing the labium in the retracted position (lower left), anterior part of the prementum and labial palps in dorsal (lower center) and ventral view (lower right), and the apex of the abdomen in dorsal view (upper right). Based on Santos *et al.* (1987).

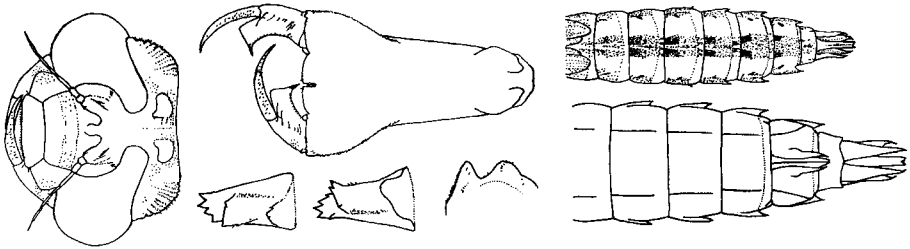


Fig. 3.2.540 *Gynacantha mexicana* larva: head in dorsal view (left), labium in dorsal view (upper center), mandibles in interior view (lower left center), pleural processes on the prothorax in dorsal view (lower right center), abdomen in dorsal view (upper right), and the apical half of the abdomen of a female larva in ventral view (lower right). Based on Carvalho and Ferreira (1989).

2. There is a distinct dark median stripe but no colored lateral stripes on the thorax and abdomen. There are two dark rings on each of the femora and tibiae. The cerci are distinctly shorter than the epiproct (**Fig. 3.2.539**).

.....*Gynacantha membranalis* Karsch, 1891
(Central America, Colombia, Ecuador, Peru, Venezuela, Bolivia, Guyana, French Guiana, Surinam, Pará). Syn: *Gynacantha jubilaris* Navás, 1915.

- There are distinct dark lateral stripes on the thorax and abdomen. There are four dark rings on each of the femora and tibiae. The cerci and epiproct are approximately equal in size (**Fig. 3.2.540**).3
 3. There are not more than ten setae on each labial palp, and the distal setae are only moderately developed. The dark dorsal stripe is more prominent than the lateral stripes (**Fig. 3.2.540**).

.....*Gynacantha mexicana* Selys, 1869
 (Mexico, Central America, Ecuador, Peru, Colombia, Venezuela, French Guiana, Surinam, Guyana, Bolivia, Pará).

- There are more than ten setae on each labial palp, and at least the two distal setae are well developed. Both dark dorsal and the lateral stripes are prominent (**Fig. 3.2.541**).4

4. The palpal setae diminish uniformly and gradually in size from the apex to the base of the palp. The dark dorsal stripe is sharply defined on the thorax but more diffuse on the abdomen.

.....*Gynacantha nervosa* Rambur, 1842
 (North and Central America, West Indies, Colombia, Ecuador, Peru, Venezuela, Guyana, French Guiana, Surinam, Bolivia, Mato Grosso).

- The two apical setae are much larger than the others more basal in the row. The dark dorsal stripe is equally well defined on the thorax and abdomen (**Fig. 3.2.541**).

.....*Gynacantha bifida* Rambur, 1842
 (Peru, Venezuela, Argentina, Paraguay, Minas Gerais, São Paulo, Rio de Janeiro, Santa Catarina). Syn: *Gynacantha robusta* Kolbe, 1888.

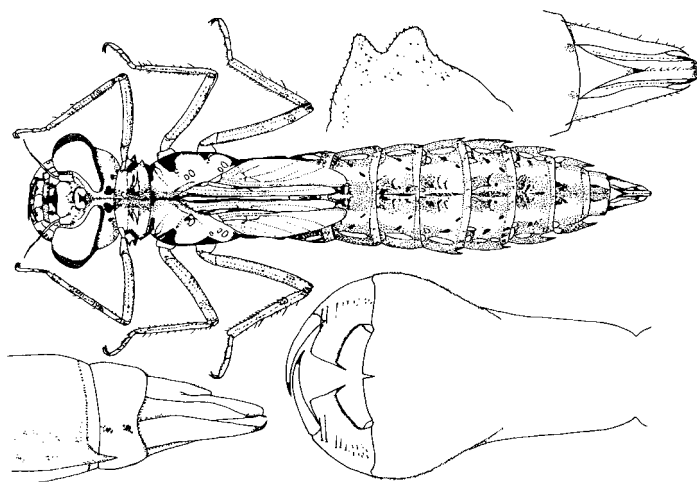


Fig. 3.2.541 *Gynacantha bifida* male larva: habitus of exuvia (upper left), dorsal view of the labium (lower right), pleural processes on prothorax (upper center), and the apex of the abdomen in dorsal (upper right) and lateral view (lower left). Based on Carvalho (1987).

Key to the species of adult *Triacanthagyna* in South America

Information for the key was provided by Williamson (1923b), Pastor (1968), and von Ellenrieder and Garrison (2003).

1. The occipital triangle and the legs are entirely black. The superior anal appendage of the male is wider at the apex than at the base. The synthorax of the male has dark middorsal, humeral, interpleural, and metapleural stripes. The lateral processes of the ventral extension of the tenth abdominal segment of the female are each only about half as long as the medial process. The abdomen is narrowed at the third segment (**Fig. 3.2.542**). The thorax is reddish brown, and the legs and abdomen are mainly blackish.

.....*Triacanthagyna dentata* (Geijskes, 1943)
(Mexico, Central America, French Guiana, Surinam, and Brazil). Syn: *Coryphaeschna dentata* Geijskes, 1943.

- The occipital triangle and legs are not entirely black (**Fig. 3.2.543**), or the synthorax of the male has only a dark middorsal stripe.2

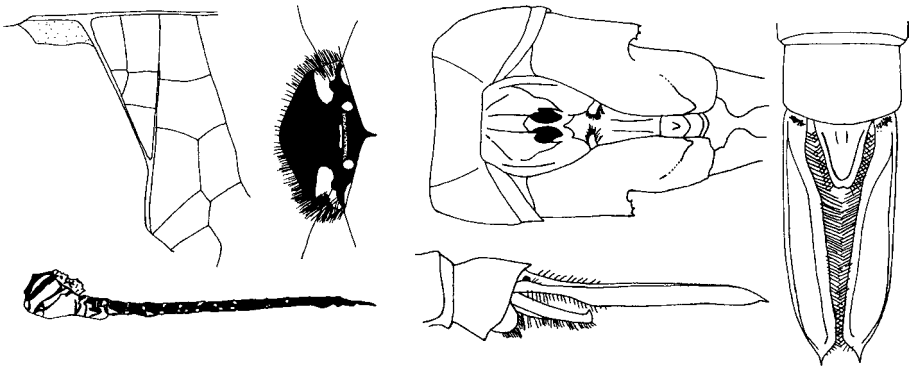


Fig. 3.2.542 *Triacanthagyna dentata* male (above, left to right): anal triangle of the fore-wing, the frons showing the shape of the T-mark, genitalia on the second abdominal segment in ventral view, apex of the abdomen in dorsal view (far right), and (lower row, left and right, respectively): lateral view of the thorax and abdomen showing the color pattern and the apex of the abdomen in lateral view. Based the figures of “*Coryphaeschna dentata*” by Geijskes (1943).

2. The only dark stripe on the synthorax is a middorsal stripe. There is a sclerotized bifid process at the apex of the vesica sperminalis. The anterior margin of the frons is not evenly rounded and forms an obtuse angle (**Fig. 3.2.543**).

.....*Triacanthagyna obscuripennis* (Blanchard, 1845)
(Panama, Peru, Bolivia). Syn: *Aeschna obscuripennis* Blanchard, 1845.

- The synthorax has either more than one dark stripe, or it is uniform in color without any dark markings.3

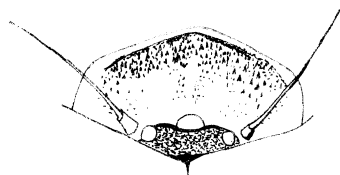


Fig. 3.2.543 The frons of *Triacanthagyna obscuripennis* in dorsal view. Based on von Ellenrieder and Garrison (2003).

3. The thorax is uniform dark olive without dark stripes or other markings. The abdomen and legs are light in color. The third abdominal segment of the male is only slightly constricted. The anterior edge of the frons is convex when viewed from above. The occipital triangle of the female is pale in color. The abdomen is not narrowed at the third segment. The superior anal appendages of the male are produced on the inner corners at their apices (**Fig. 3.2.544**). The head and abdomen are reddish brown. The thorax of the male is olive green, and that of the female is dull olive brown. The wings are hyaline with yellowish brown pterostigmas.

.....*Triacanthagyna septima* (Selys in Sagra, 1857)
 (Mexico, Central America, West Indies, Colombia, Ecuador, Peru, Venezuela, French Guiana, Guyana, French Guiana, Surinam, Bolivia, Rio de Janeiro). Syn: *Gynacantha septima* Selys in Sagra, 1857.

- The thorax has dark markings. The abdomen and legs are at least partially dark in color. The anterior edge of the frons is angular when viewed from above. The occipital triangle is always pale. The abdomen is narrowed considerably at the third segment (**Fig. 3.2.545**).4

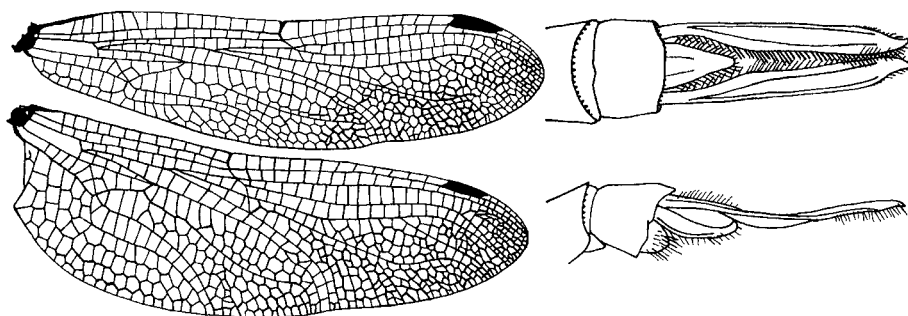


Fig. 3.2.544 *Triacanthagyna septima*: fore and hind wing (left), apex of the abdomen of a male in dorsal (upper right) and lateral view (lower right). Based on Williamson (1923b).

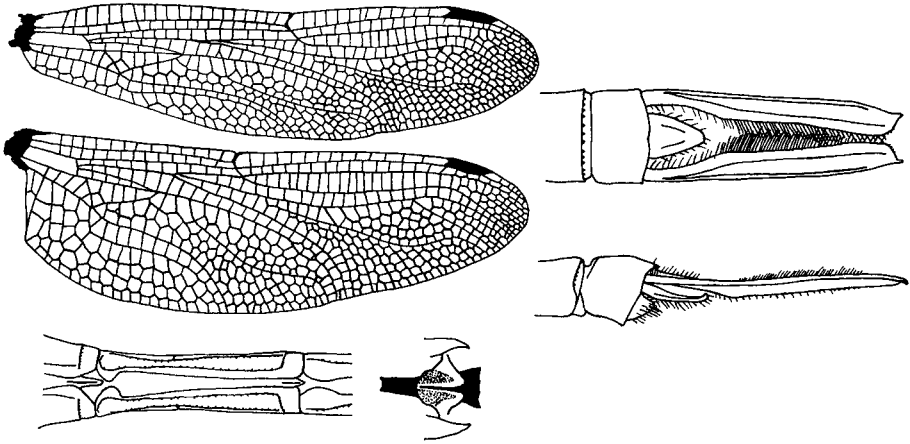


Fig. 3.2.545 *Triacanthagyna ditzleri*: fore and hind wing (upper left), apex of the abdomen of a male in dorsal (upper right) and lateral view (lower right), hamular processes (lower center), and the third abdominal segment of a female in ventral view (lower left). Based on Williamson (1923b).

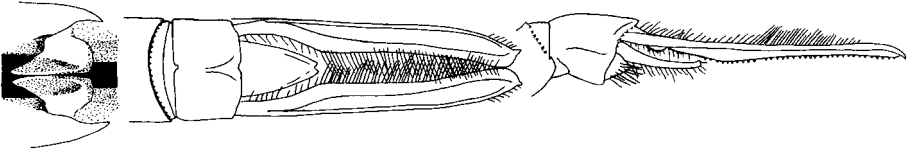


Fig. 3.2.546 *Triacanthagyna satyrus* male (left to right): the hamule visible in a ventral view of the genitalia on the second abdominal segment and the apex of the abdomen in dorsal and lateral view. Based on Williamson (1923b).

4. Males, with genitalia on the ventral side of the second abdominal segment (**Fig. 3.2.3**).5
 - Females, without such genital structures.10
5. In dorsal view, no prominent “heel” is apparent on the superior anal appendage of the male, and there are no denticles on the male genital lobe (**Fig. 3.2.545**).6
 - There is either a prominent “heel” on the superior anal appendage of the male that is visible in dorsal view, or there are at least a few weak denticles on the male genital lobe. There are usually three cells in the anterior row of the anal loop. The hamular process is equal to more than 1/3 of the distance from its posterior edge to the anterior end of the median sulcus of the anterior lamina (**Fig. 3.2.546**).7

6. The anterior process on the hamulus appears short in ventral view, its length much less than $1/3$ of the distance from its posterior edge to the anterior end of the median sulcus of the anterior lamina. There are usually two cells in the anterior row of the anal loop. The middle and hind femora are similar in color. The male genital lobe lacks denticles, and there is a well-developed sub-basal tooth on the superior anal appendage. The sides of the superior appendage of the blade are parallel beyond the narrowed base. The anal appendages are about as long as the three posteriormost segments. The superior anal appendages of the male are produced on the outer corners at their apices (**Fig. 3.2.545**). Abdomen length of male: 36 to 40 mm. Hind wing length of male: 33 to 36 mm. The ground color of the male is dark reddish brown to blackish, but the thorax is lighter reddish brown with a prominent greenish tinge on the lateral surfaces of the thorax and anterior abdominal segments. The wings are completely hyaline, and the pterostigma is reddish yellow.

.....*Triacanthagyna ditzleri* Williamson, 1923
(Mexico, Central America, Trinidad, Colombia, Peru, Venezuela, Guyana, French Guiana, Surinam, Bolivia, Paraguay, Pará, Rio de Janeiro, Santa Catarina, Rio Grande do Sul, Mato Grosso). Syn: *Gynacantha nympa* Navás, 1933.

- In ventral view, the hamular process on the second abdominal segment of the male appears relatively long, equal to more than $1/3$ of the distance from its posterior edge to the anterior end of the median sulcus of the anterior lamina. The anterior ridge on the frons is slightly concave lateral to the midline (**Fig. 3.2.547**).

.....*Triacanthagyna williamsoni* von Ellenrieder and Garrison, 2003
(Peru, Bolivia).

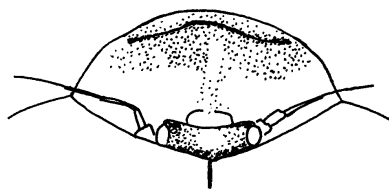


Fig. 3.2.547 The frons of *Triacanthagyna williamsoni* in dorsal view. Based on von Ellenrieder and Garrison (2003).

7. The apical part of the genital lobe is armed with 10 to 20 strong, black denticles. The hamular process is about 7 mm long. In dorsal or ventral view, the apex of the inferior anal appendage appears broadly convex (**Fig. 3.2.546**). Abdomen length of male: 42 to 43 mm. Hind wing length of male: 39 to 42 mm. The ground color is reddish brown becoming blackish on the dorsal side and at the apex of the abdomen. The thorax of the male has a strong greenish tinge laterally. The wings may have a yellowish tinge, somewhat darker in the

male. The pterostigma of the male fore-wing is blackish, and that of the hind wing is reddish brown. All pterostigmas of the female are reddish brown.

.....*Triacanthagyna satyrus* (Martin, 1909)
(Central America, West Indies, Peru, Ecuador, Venezuela, Guyana, French Guiana, Paraguay, Rio de Janeiro). Syn: *Gynacantha satyrus* Martin, 1909.

- If there are any denticles at all on the genital lobe, they do not exceed six in number and are small (**Fig. 3.2.548**).8

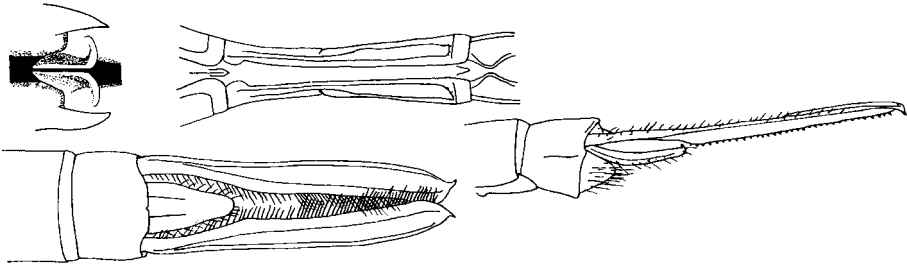


Fig. 3.2.548 *Triacanthagyna trifida* male: the hamule visible in a ventral view of the genitalia on the second abdominal segment (upper left), the third abdominal segment in ventral view (upper center), and the apex of the abdomen in dorsal (lower left) and lateral view (right). Based on Williamson (1923b).

8. There is at most a vestigial sub-basal tooth on the superior anal appendage between the base and heel. There are sometimes from one to six small denticles near the apex of the genital lobe (**Fig. 3.2.431**). The middle and hind femora are not similar in color. The mesal edges of the hamular process diverge posteriorly. The internal dorsal faces of the superior appendage of the blade converge slightly posteriorly beyond the narrowed base. Abdomen length of male: 41 to 45 mm. Hind wing length of male: 39 to 45 mm. The ground color is dark reddish brown, and there are iridescent green areas on the lateral surfaces of the synthorax and anterior adominal segments.

.....*Triacanthagyna caribbea* Williamson, 1923
(Mexico, Central America, West Indies, Trinidad, Colombia, Venezuela, French Guiana, Surinam, Bolivia, Rio de Janeiro).

- There is a well-developed sub-basal tooth on the superior anal appendage between the base and heel. There are never any denticles on the genital lobe. The middle and hind femora are similar in color. The mesal edges of the hamular process are subparallel. The internal dorsal face of the superior appendage of the blade is parallel beyond the narrowed base.9

9. In dorsal view, the distal spine on the superior anal appendage is directed posteriad and outward, and the heel on this appendage appears weakly developed in both dorsal and mediodorsal view. The hamular process is less than

6 mm long. The margin of the genital fossa lacks spines. In dorsal or ventral view, the apex of the inferior anal appendage of the male is obviously excavated in the middle (**Fig. 3.2.548**). Abdomen length of male: 42 to 45 mm. Hind wing length of male: 41 to 43 mm.

.....*Triacanthagyna trifida* (Rambur, 1842)
(North and Central America, West Indies, Colombia, Surinam, Bolivia, Paraguay, Mato Grosso). According to von Ellenrieder and Garrison (2003), the occurrence of this species in Central and South America has not been confirmed because of earlier confusion with other species. They limited its known range to eastern North American and the West Indies. Syn: *Gynacantha trifida* Rambur, 1842 through misidentification; *Triacanthagyna needhami* Martin, 1909.

- In dorsal view, the distal spine on the superior anal appendage is directed outward, and the heel on this appendage appears strongly developed in dorsal and mediodorsal view. There is no basal fold on the lateral lobe of the penis (**Fig. 3.2.549**).

.....*Triacanthagyna nympa* Navás, 1932
(Argentina, Paraguay, Brazil).

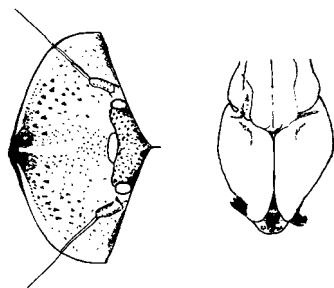


Fig. 3.2.549 *Triacanthagyna nympa*: frons in dorsal view (left) and apex of penis in ventral view (right). Based on von Ellenrieder and Garrison (2003).

10. The part of the ventral sternite on the third abdominal segment apical from the transverse carina is less than twice as wide as the part basal to the carina (**Fig. 3.2.545**).11

- The part of the ventral sternite on the third abdominal segment apical from the transverse carina is more than twice as wide as the part basal to the carina (**Fig. 3.2.548**).13

11. The middle third of the ventral sternite on the third abdominal segment is clearly narrower than the anterior and posterior thirds; at the transverse carina, the ventral carina is concave (**Fig. 3.2.545**). There are usually two cells in the anterior row of the anal loop. The middle and hind femora are similar in color. The abdomen of the female is very slightly constricted, but anterior to the transverse carina on the third abdominal segment, the sternite is wider than half of its width in the apical half of the segment. Length of female abdomen: 41 to 43 mm. Hind wing length of female: 37 to 42 mm. The female is lighter reddish

brown than the male and has olive green on the lateral surfaces of the anterior abdominal segments. The wings are completely hyaline, and the pterostigma is reddish yellow.

.....*Triacanthagyna ditzleri* Williamson, 1923
(Mexico, Central America, Trinidad, Colombia, Peru, Venezuela, Guyana, French Guiana, Surinam, Bolivia, Paraguay, Pará, Rio de Janeiro, Santa Catarina, Rio Grande do Sul, Mato Grosso). Syn: *Gynacantha nympha* Navás, 1933.

- The ventral sternite on the third abdominal segment has sides that are approximately parallel (**Fig. 3.2.431**).12

12. The femora and tibiae of the fore-legs are usually darker than those of the middle and hind legs. Length of female abdomen: c. 43 mm. Hind wing of female: c. 41 mm. The ground color is reddish brown becoming blackish on the dorsal side and at the apex of the abdomen. The thorax of the male has a strong greenish tinge laterally. The wings may have a yellowish tinge, somewhat darker in the male. All pterostigmas of the female are reddish brown. The descriptions here do not hold true in all cases, and the female of this species cannot be reliably distinguished from that of *Triacanthagyna caribbea*.

.....*Triacanthagyna satyrus* (Martin, 1909)
(Central America, West Indies, Peru, Ecuador, Venezuela, Guyana, French Guiana, Paraguay, Rio de Janeiro). Syn: *Gynacantha satyrus* Martin, 1909.

- The femora and tibiae of all legs are usually about the same color, reddish brown with blackened apical portions of the femora and basal portions of the tibiae. The anal appendages are slightly shorter than the three posteriormost segments (**Fig. 3.2.431**). Length of the female abdomen: 44 to 47 mm. Hind wing length of female: 42 to 46 mm. The ground color is dark reddish brown, and there are iridescent green areas on the lateral surfaces of the synthorax and anterior adominal segments. The female of this species cannot always be reliably distinguished from that of *Triacanthagyna satyrus*.

.....*Triacanthagyna caribbea* Williamson, 1923
(Mexico, Central America, West Indies, Trinidad, Colombia, Venezuela, French Guiana, Surinam, Bolivia, Rio de Janeiro).

13. The ventral sternite of the third abdominal segment is constricted abruptly at midlength (**Fig. 3.2.548**). Length of female abdomen: 47 to 50 mm. Hind wing length of female: 44 to 47 mm.

.....*Triacanthagyna trifida* (Rambur, 1842)
(North and Central America, West Indies, Colombia, Surinam, Bolivia, Paraguay, Mato Grosso). According to von Ellenrieder and Garrison (2003), the occurrence of this species in Central and South America has not been confirmed because of earlier confusion with other species. They limited its known range to eastern North American and the West Indies. Syn: *Gynacantha trifida* Rambur, 1842 through misidentification; *Triacanthagyna needhami* Martin, 1909.

- The ventral sternite of the third abdominal segment narrows gradually from the anterior end to its midlength.14

14. The ventral sternites of the fourth and fifth abdominal segments narrow about 1/5 of the way from the anterior to the posterior end.

.....*Triacanthagyna nympa* Navás, 1932
(Argentina, Paraguay, Brazil).

- The sides of the ventral sternites of the fourth and fifth abdominal segments are nearly parallel.

.....*Triacanthagyna williamsoni* von Ellenrieder and Garrison, 2003
(Peru, Bolivia).

Key to the species of known *Triacanthagyna* larvae in South America

Information for the key was provided by Calil and Carvalho (1999), which is valid only for the final instar larvae. The larvae of most species are unknown.

1. The cerci are distinctly shorter than the epiprocts (**Fig. 3.2.550**).

.....*Triacanthagyna septima* (Selys in Sagra, 1857)
(Mexico, Central America, West Indies, Colombia, Ecuador, Peru, Venezuela, Guyana, French Guiana, Surinam, Bolivia, Mato Grosso, Bahia, Espirito Santo, Minas Gerais, Rio de Janeiro). Syn: *Gynacantha septima* Selys in Sagra, 1857.

- The cerci are about as long as the epiprocts (**Fig. 3.2.551**).2

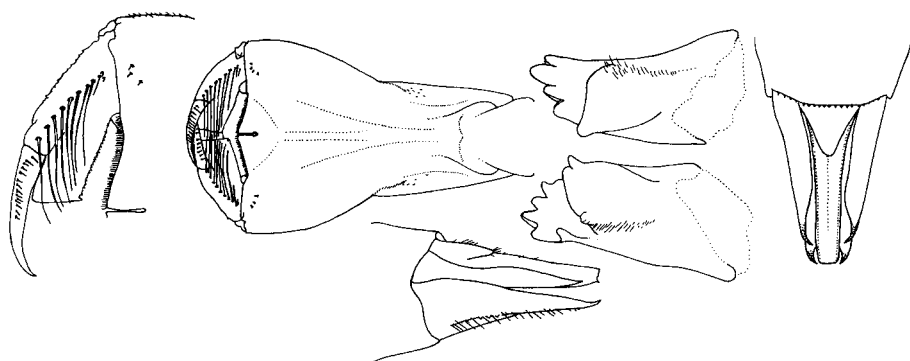


Fig. 3.2.550 *Triacanthagyna septima* larva: labial palp and anterior margin of the prementum in dorsal view (left), labium in dorsal view (upper left center), interior surfaces of the mandibles (upper right center), and the apex of the abdomen in dorsal (right) and lateral view (lower center). Based on Calil and Carvalho (1999).

2. The dorsal surface of the abdomen is relatively uniform in color without distinct dark longitudinal stripes. There are about eight distal palpal setae (**Fig. 3.2.8**).

.....*Triacanthagyna caribbea* Williamson, 1923
(Mexico, Central America, West Indies, Trinidad, Colombia, Venezuela, French Guiana, Surinam, Bolivia, Rio de Janeiro).

- The color pattern on the dorsal surface of the abdomen is dominated by distinct dark longitudinal stripes. There are fewer than five distal palpal setae (**Fig. 3.2.441**).3

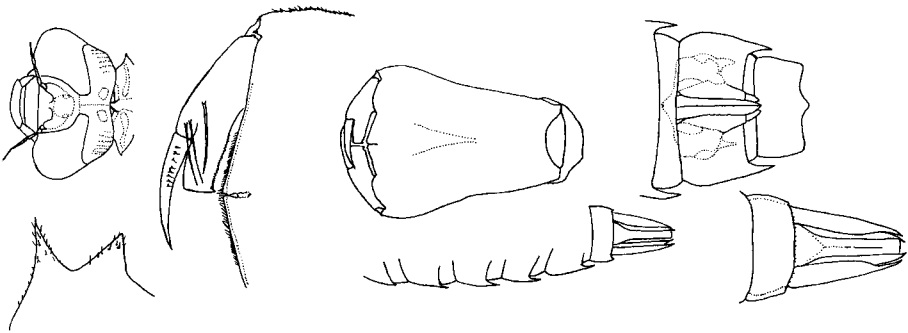


Fig. 3.2.551 *Triacanthagyna dentata* larva: head in dorsal view (upper left), supracoxal process of the prothorax in dorsal view (lower left), anterior margin of the prementum and right labial palp in dorsal view (left center), labium (upper right center), left margin of the apical abdominal segments in dorsal view (lower right center), ninth abdominal segment in ventral view (upper right), and apex of the abdomen in dorsal view (lower right). Based on DeMarmels (1992d).

3. There are three distal palpal setae and no basal setae (**Fig. 3.2.551**).

.....*Triacanthagyna dentata* (Geijskes, 1943)
(Mexico, Central America, French Guiana, Surinam, and Brazil). Syn: *Coryphaeschna dentata* Geijskes, 1943.

- There are four distal palpal setae, and basal setae are present (**Fig. 3.2.441**).

.....*Triacanthagyna ditzleri* Williamson, 1923
(Mexico, Central America, Trinidad, Colombia, Peru, Venezuela, Guyana, French Guiana, Surinam, Bolivia, Paraguay, Pará, Rio de Janeiro, Santa Catarina, Rio Grande do Sul, Mato Grosso). Syn: *Gynacantha nympha* Navás, 1933.

Key to the species of adult *Neuraeschna* in South America

Information for the key was provided by Kimmins (1951), Belle (1989), Machet (1990), and Machado (2002b). According to Belle (1989), *Neuraeschna rostrifera* Martin, 1909 was probably listed from Surinam because a museum label stating “Sumatra” was misread. The identity of the only specimen ascribed to this species is the Old World *Heliaeschna simplicia* (Karsch, 1891). Most descriptions are based on few specimens, and the number of species may be reduced after more is known about intraspecific variability.

1. There is a well-defined, brown T-spot on the dorsal surface of the frons (**Fig. 3.2.552**). Total length, excluding appendages: 73 to 78 mm. Length of abdomen, excluding appendages: 73 to 78 mm. Hind wing length of male: 52 to 54 mm; female: 55 to 60 mm.

.....*Neuraeschna harpya* Martin, 1909 (Peru, Venezuela, French Guiana, Guyana, Surinam, Amazonas, Pará).

- There is no brown T-spot on the dorsal surface of the frons. The anterior part of the frons is dark, and it may become lighter toward the base (**Fig. 3.2.553**). ...2

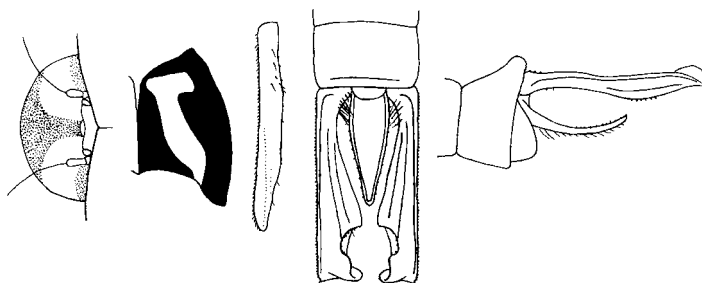


Fig. 3.2.552 *Neuraeschna harpya* (left to right): the T-spot on the dorsal surface of the frons of a male, pattern on the left lateral part of the dorsal surface of the thorax of a male, the left anal appendage of a female, and the apex of the abdomen of a male in dorsal and lateral view. Based on Belle (1989).

2. The hind wing is shorter than 54 mm.3

- The hind wing is longer than 54 mm.9

3. The superior anal appendage is twice as long as the inferior (**Fig. 3.2.553**). The wings of females and most males have brown markings at the base, which may be diffuse.4

- The superior appendage is 1/3 longer than the inferior (**Fig. 3.2.554**). There are no basal spots on the wings of the one known female in this group. There is a stout dentiform process near the middle of the dorsal surface of each superior anal appendage of the male. The hind wing of the only known female in this group is 46 to 48 mm long and 13 mm wide at the level of the nodus. The pterostigma of the fore-wing is 3.5 to 4 mm long along the costal margin.6

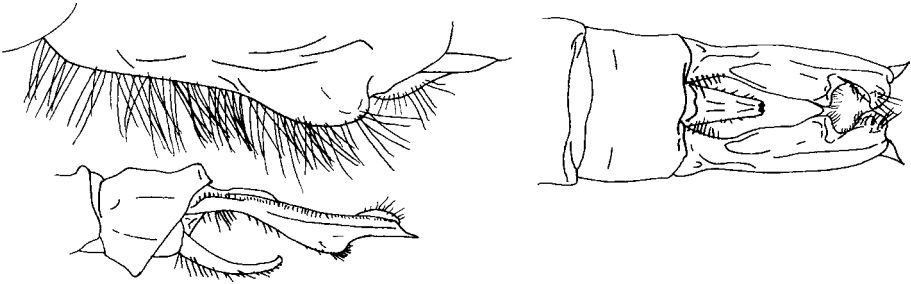


Fig. 3.2.553 *Neuraeschna capillata* male: the ventral side of the second abdominal appendage in lateral view (upper left) and the apex of the abdomen in dorsal (right) and lateral view (lower left). Based on Machet (1990).

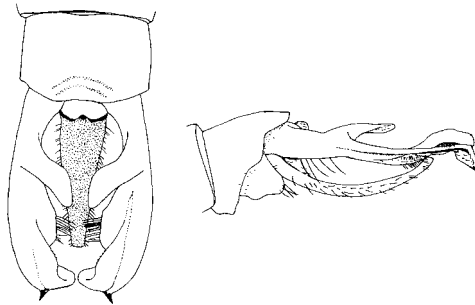


Fig. 3.2.554 *Neuraeschna tapajonica* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Machado (2002b).

4. The synthorax is dark brown dorsally and a lighter brownish red laterally with a straight greenish antehumeral stripe, a mesepimeral stripe about $\frac{1}{4}$ the width of of the mesepimeron, a dorsal metepisternal spot, and a relatively narrow metepimeral stripe. The wings of the male are entirely brownish with brownish black veins and a brown pterostigma, about 4.0 mm long; those of the female are hyaline with brown basal patches extending beyond the most proximal antehumeral cross veins and pterostigmas 4.0 to 4.2 mm long. There is a short ridge on the dorsal side of the superior anal appendage of the male. The width of the inferior anal appendage of the male at its base is more than $\frac{2}{3}$ of its length (**Fig. 3.2.432**). Total length: 66 to 72 mm. Length of male abdomen with appendages: c. 56 mm; female abdomen: c. 51 mm. Hind wing length: 48 to 49 mm. The general coloration is mainly shades of brown and reddish brown with green and blackish markings.

.....*Neuraeschna clavulata* Machet, 1990
(French Guiana).

- The synthorax is brownish black dorsally and a lighter brownish red laterally with a greenish antehumeral stripe that extends ventrally to assume a triangular shape along the antealar sinus. The mesopleural and metapleural sutures have pale borders, and the green mesepimeral and metepimeral stripes are about $\frac{1}{2}$ the width of their respective sclerites. There is also a green dorsal metepisternal spot. The width of the inferior anal appendage of the male at its base is less than $\frac{2}{3}$ of its length (**Fig. 3.2.553**).5

5. The genital lobe on the second abdominal segment of the male is rounded evenly along its ventral surface, and the margins of the genitalia are lined with many long setae. A low ridge is present on the dorsal side of the superior anal appendage (**Fig. 3.2.553**). Total length: c. 73 mm. Length of male abdomen with appendages: c. 57 mm. Hind wing length: c. 50 mm. The pterostigma in the fore-wing is about 3.5 mm long, and that in the hind wing is about 2.5 mm. The general coloration is mainly shades of brown and reddish brown with green and blackish markings.

.....*Neuraeschna capillata* Machet, 1990
(French Guiana).

- The superior anal appendages of the male do not have stout, dentiform processes or anything more than a vestige of a dorsal ridge, most prominent about $\frac{1}{3}$ of the way from the base to the apex (**Fig. 3.2.555**). The wings of the female have diffuse brown markings at the base, which sometimes extend as far as the second primary antenodal cross vein. The hind wing of the female is 50 to 51 mm long and 14 mm wide at the level of the nodus. The pterostigma of the fore-wing is 4 to 4.5 mm long along the costal margin. Total length of male, excluding appendages: 70 to 75 mm; female: 67 to 69 mm. Length of male abdomen, excluding appendages: 56 to 58 mm; female: 51 to 54 mm. Hind wing length of male: 49 to 51 mm.

.....*Neuraeschna claviforcipata* Martin, 1909
(Ecuador, Venezuela, French Guiana, Surinam, Amazonas, Pará).

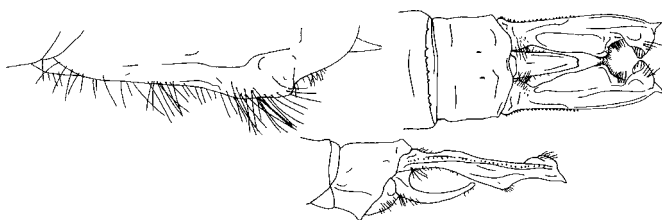


Fig. 3.2.555 *Neuraeschna claviforcipata* male: genital region of the second abdominal segment in lateral view (left), and the apex of the abdomen in dorsal (upper right) and lateral view (lower center). Based on Machet (1990).

6. Pale mesepimeral and metepimeral stripes are absent. Beware of specimens that have lost these stripes in the preservative. In dorsal view, the subapical tubercle on the interior margin of the superior anal appendage of the male is

rectangular in outline, bears a tuft of setae, and does not extend as far toward the midline as the dentiform process. All of the dentiform process is visible in lateral view, and its distal part is directed posteriad (**Fig. 3.2.554**). Only the male has been described. Total length: c. 64 mm. Length of abdomen, including appendages: c. 49 mm. Length of both the fore and hind wing: c. 40.5 mm. Length of the costal margin of the pterostigma in the fore-wing: 3.4 mm; in the hind wing: 2.4 mm.

.....*Neuraeschna tapajonica* Machado, 2002 (Pará).

- Pale mesepimeral and metepimeral stripes are present. In dorsal view, the subapical tubercle on the interior margin of the superior anal appendage of the male is triangular in outline and does not bear a tuft of setae or extend as far toward the midline as the dentiform process. Only the upper part of the dentiform process is visible in lateral view, and its distal part is directed toward the middle (**Fig. 3.2.556**). The hind wing is longer than 41 mm.7



Fig. 3.2.556 *Neuraeschna mina* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Belle (1989).

7. The base of the dentiform process on the superior anal appendage of the male is about 1/3 as long as the process. In lateral view, the basal 2/3 of the inferior anal appendage is horizontal; it then curves slightly dorsad and then remains straight to its apex (**Fig. 3.2.556**). The female has not been described.

.....*Neuraeschna mina* Williamson and Williamson, 1930 (Rondônia).

- The dentiform process is shorter. In lateral view, the inferior anal appendage is curved for its entire length (**Fig. 3.2.557**).8

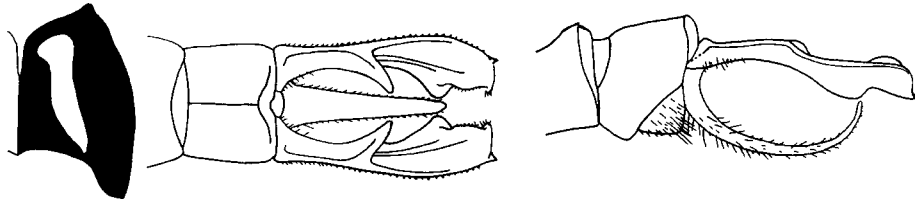


Fig. 3.2.557 *Neuraeschna dentigera* male (left to right): pattern on the left lateral part of the dorsal surface of the thorax and the apex of the abdomen in dorsal and lateral view. Based on Belle (1989).

8. The apex of the superior anal appendage of the male is truncate. The inferior anal appendage is inflated on the dorsal side at the base and visible in dorsal view (**Fig. 3.2.557**). Total length: 64 to 69 mm. Length of abdomen: 49 to 54 mm. Hind wing length of male: 43 to 46 mm; female: 46 to 48 mm. Width of female hind wing at the nodus: 12.5 to 13.5 mm. Pterostigma length in fore-wing along the costal margin: 3.9 to 5.0 mm; in the hind wing: 2.7 to 3.0 mm.

.....*Neuraeschna dentigera* Martin, 1909
(Peru, Guyana, Surinam, Pará). Syn: *Neuraeschna inarmata* Kimmins, 1951.

- The apex of the superior anal appendage of the male tapers to a point. The inferior anal appendage is not inflated at the base (**Fig. 3.2.558**). Total length: c. 67 mm. Length of abdomen, including 4.9 mm appendages: c. 51.5 mm. Hind wing length: c. 44 mm. Pterostigma length in fore-wing along the costal margin: c. 3.3 mm; in the hind wing: c. 2.5 mm. The female has not been described.

.....*Neuraeschna cornuta* Belle, 1989
(Surinam).

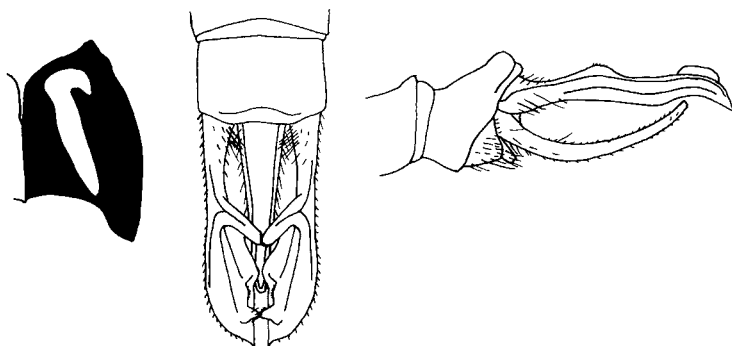


Fig. 3.2.558 *Neuraeschna cornuta* (left to right): pattern on the left lateral part of the dorsal surface of the thorax and the apex of the abdomen of a male in dorsal and lateral view. Based on Belle (1989).

9. A basal cross vein is lacking in the costal but present in the subcostal space of the female. In lateral view, the forked branch on the tenth sternite of the female distinctly rises before reaching the level of the posterior border of the sternite (**Fig. 3.2.559**). Total length, excluding appendages: c. 85 mm. Length of abdomen, excluding appendages: 65 mm. Hind wing: c. 61 mm long and 17.5 mm wide at the nodus. Pterostigma in the fore-wing: c. 4.5 mm along the costal edge. The male has not been described.

.....*Neuraeschna mayoruna* Belle, 1989
(Peru).

- A basal cross vein is present in both the costal and subcostal space. In lateral view, the forked branch on the tenth sternite of the female rises no more than slightly before reaching the level of the posterior border of the sternite (**Fig. 3.2.560**).

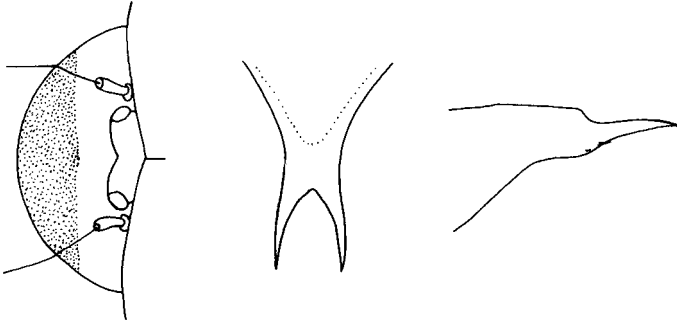


Fig. 3.2.559 *Neuraeschna mayoruna* female (left to right): dark brown and pale brown pattern on the frons and the forked ventral process on the tenth abdominal segment in ventral and lateral view. Based on Belle (1989).

10. The superior appendages of the male are long, narrow, and forceps-like. The outer margin of the superior anal appendage of the male appears evenly curved convexly for its whole length in dorsal view. The first two segments of the female abdomen are inflated, and the third segment is greatly constricted, so in ventral view, the second segment is three times as wide as the middle of the third (**Fig. 3.2.560**). Total length, excluding appendages: 97 to 100 mm. Hind wing length of male: c. 67 mm; female: c. 70 mm and 19 mm wide at the level of the nodus. Pterostigma length in the fore-wing: c. 6 mm along the costal margin.

.....*Neuraeschna maxima* Belle, 1989 (Pará).

- The superior anal appendages of the male are wide and flattened. The outer margin of the superior anal appendage of the male appears nearly straight in dorsal view (**Fig. 3.2.561**). The first two segments of the female abdomen are inflated, but the third segment is only slightly constricted.11

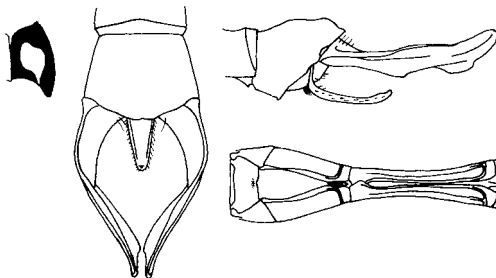


Fig. 3.2.560 *Neuraeschna maxima* (left to right): pattern on the left lateral part of the dorsal surface of the thorax, apex of the abdomen of a male in dorsal and lateral (above) view, and the anterior part of the female abdomen in ventral view (below). Based on Belle (1989).

11. In lateral view, the raised dorsal edge at the apex of the superior anal appendage appears to be drawn out into a long, strong point. The vertex of the female is black, the length of the pterostigma in the fore-wing is 9% to 10% of the length of the wing, and the forked process on the tenth abdominal sternite is bent caudad in lateral view (**Fig. 3.2.561**). The brown costal stripe is relatively weak and does not usually extend into the space posterior to vein R_1 between the arculus and subnodus. The hind wing of the male is 56 to 62 mm long, and that of the female is 59 to 64 mm long and 17 to 18 mm wide at the level of the nodus. The pterostigma of the fore-wing of the male is 3.6 to 4.6 mm long along the costal margin, and that of the female is 5.0 to 6.2 mm long. Total length of male: 82 to 91 mm; female without appendages: 81 to 85 mm. Length of male abdomen including appendages: 62 to 71 mm; female abdomen without appendages: 61 to 64 mm.

..... *Neuraeschna costalis* (Burmeister, 1839)
(Ecuador, Venezuela, Guyana, French Guiana, Surinam, Amazonas, Pará, São Paulo). Syn: *Aeshna costalis* Burmeister, 1839; *Neuraeschna ferox* Erichson, 1848; *Neuraeschna costalis* var. *hyalinata* Belle, 1989; *Neuraeschna costalis* var. *marginata* Belle, 1989.

- In lateral view, the raised dorsal edge at the apex of the superior anal appendage appears rhomboidal with rounded edges. The vertex of the female is brown; or, if not, the length of the pterostigma in the fore-wing is 7.7% to 8.1% of the length of the wing; or, if not, the forked process on the tenth abdominal sternite is aligned nearly to the line of the rest of the sternite in lateral view (**Fig. 3.2.562**). 12

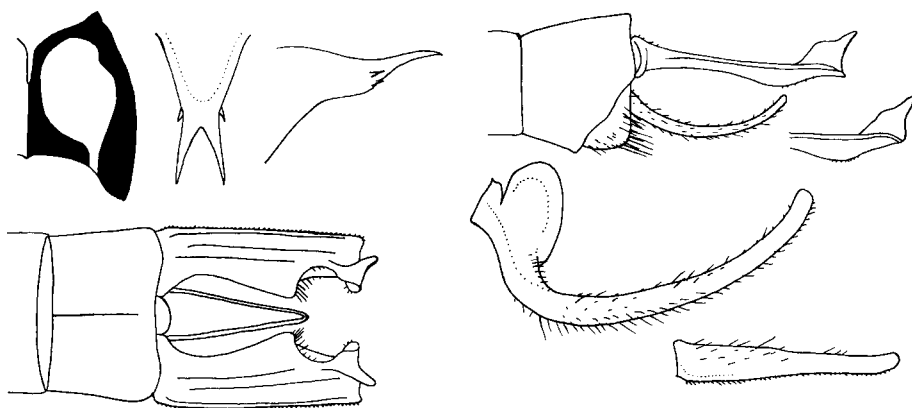


Fig. 3.2.561 *Neuraeschna costalis* (above, left to right): pattern on the left lateral part of the dorsal surface of the thorax, forked ventral process on the tenth sternite of a female in ventral and lateral view, apex of the male abdomen in lateral view and a view of the apex of the superior anal appendage, and (below, left to right): apex of the abdomen of a male in dorsal view, the entire inferior anal appendage of a male with the lamina supra-analis in lateral view and the left superior anal appendage of a female in dorsal view. Based on Belle (1989).

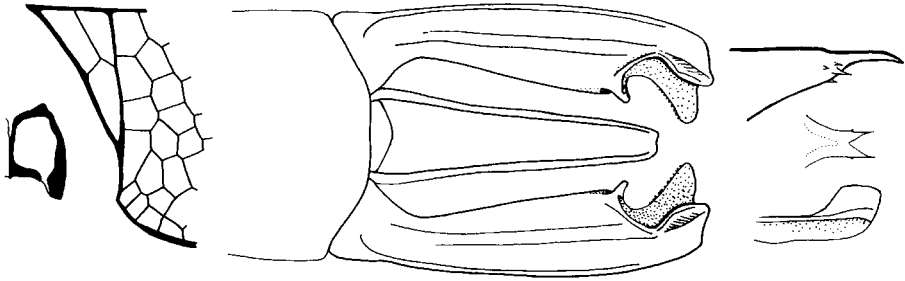


Fig. 3.2.562 *Neuraeschna calverti* (left to right): pattern on the left dorsolateral surface of the thorax, anal angle of the hind wing of a male, dorsal view of the apex of the male abdomen, apex of the male superior anal appendage in lateral view (below), and fork on the tenth sternite of a female in ventral (middle) and lateral view (above). Based on Kimmins (1951) and Belle (1989).

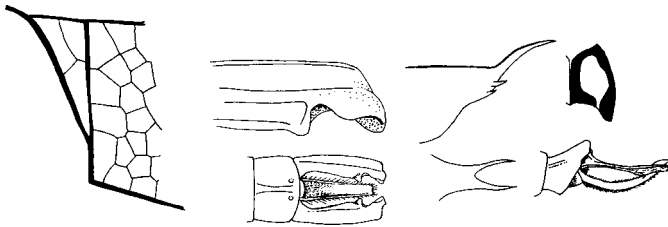


Fig. 3.2.563 *Neuraeschna producta* (left to right): anal angle of the hind wing of a male, apex of the male abdomen in dorsal view with an enlarged apex of a superior anal appendage above it, fork of the tenth sternite of a female in lateral (above) and ventral view (below), and pattern on the left lateral part of the dorsal surface of the thorax above a lateral view of the male abdomen. Based on Kimmins (1951) and Belle (1989).

12. The inner margin of the superior anal appendage of the male has a blunt spine-like projection at the inner proximal angle of the apical excision (**Fig. 3.2.562**). The vertex of the female is brown. If a costal stripe is present at all on the wings of the female, it is very weak. The hind wing of the female is 59 mm long and 16.5 mm wide at the level of the nodus. The pterostigma in the forewing is 4.5 to 5.5 mm long along the costal edge of the wing.

.....*Neuraeschna calverti* Kimmins, 1951 (Peru, Amazonas).

- The vertex is black and the hind wing is longer and wider.13
13. In lateral view, a dorsal extension of the base of the inferior anal appendage of the male extends dorsal to the superior anal appendage. The exterior apical margin of the male superior anal appendage is broadly rounded (**Fig. 3.2.563**). In lateral view, the forked process on the tenth abdominal sternite of the female curves sharply caudad, and its branches are long, slender, and curved 2/3 of the

way from the base to the apex. The hind wing of the female is about 65 mm long and 17 to 18.5 mm wide at the level of the nodus. The pterostigma in the forewing of the female is about 5.5 to 6 mm long along the costal edge of the wing.

.....*Neuraeschna producta* Kimmins, 1933
(Peru, Pará).

- In lateral view, the dorsal extension of the base of the inferior anal appendage does not extend dorsal to the superior anal appendage. The exterior apical margin of the superior anal appendage is angular or pointed (**Fig. 3.2.564**). In lateral view, the forked process on the tenth abdominal sternite of the female does not curve sharply caudad, and its branches are not long, slender, or curved 2/3 of the way from the base to the apex. 14

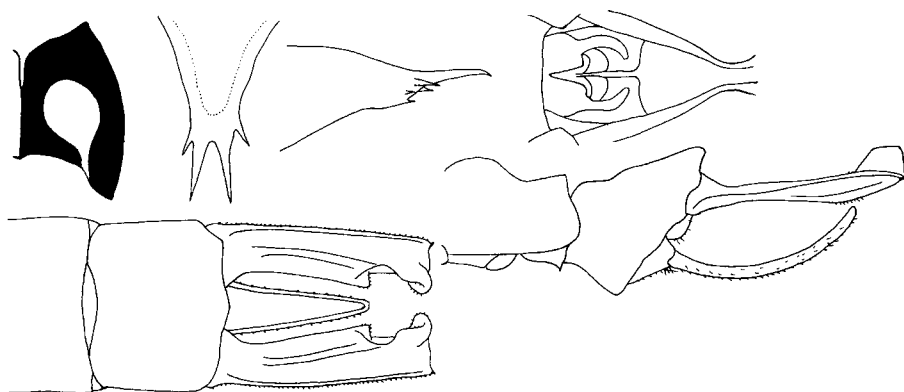


Fig. 3.2.564 *Neuraeschna titania* (above, left to right): pattern on the left lateral part of the dorsal surface of the thorax, fork of the tenth sternite of a female in ventral and lateral view, genitalia on the second abdominal segment of a male in ventral view, and (below, left and right): the apex of the abdomen of a male in dorsal and lateral view. Based on Belle (1989).



Fig. 3.2.565 *Neuraeschna maya* (left to right): pattern on the left lateral part of the dorsal surface of the thorax, forked ventral process on the tenth abdominal sternite of the female in ventral and lateral view, and the apex of the superior anal appendage of the male in dorsal view. Based on Belle (1989).

14. The outer angle of the truncate apex of the superior anal appendage of the male bears a small spine-like point directed laterad. The wings of both sexes have brown costal stripes, which extends to the space posterior to vein R_1 between the arculus and nodus. The forked process on the sternite of the tenth abdominal segment of the female continues in the direction of the ventral margin of the sternite (**Fig. 3.2.564**). Total length, excluding appendages: c. 90 mm. Length of abdomen, excluding appendages: 67 to 70 mm. Hind wing length: 63 to 68 mm, and that of the female is 18 to 19.5 mm wide at the level of the nodus. Fore-wing pterostigma of the male measured along the costal margin: c. 5.5 mm long; female: 6.4 mm, equaling 9% to 10% of the fore-wing margin. Hind wing pterostigma of male: 4.5 to 5.1 mm; female: 5.5 to 6.0 mm.

.....*Neuraeschna titania* Belle, 1989
(Ecuador, Peru).

- The outer angle of the truncate apex of the superior anal appendage of the male bears no spine-like point, but a tiny tubercle may be present on the ventral margin (**Fig. 3.2.565**). The wings have no more than weak brown costal stripes, which do not extend to the space posterior to vein R_1 between the arculus and nodus. Total length, excluding appendages: 87 to 88 mm. Length of male abdomen, including 5.8 mm appendages: c. 67 mm; female, excluding appendages: 68 mm. Hind wing length of male: c. 59 mm. The hind wing of the female is 65 to 68 mm long and 18 to 19.5 mm wide at the level of the nodus. The pterostigma in the fore-wing of the male is about 4.2 to 5.0 mm long along the costal edge of the wing, and in the hind wing, the corresponding length is 3.2 to 4.0 mm. That of the female fore-wing is 4.9 to 5.4 mm, occupying 7.7% to 8.1% of the wing margin.

.....*Neuraeschna maya* Belle, 1989
(Central America, Ecuador).

Key to the species of known *Neuraeschna* larvae in South America

Information for the key was provided by Belle (1989) and Carvalho (1989). The larvae of all but two of the South American species are yet to be adequately described, and the two that have are very similar and cannot be distinguished with certainty using the key below. Better descriptions are urgently needed.

1. The longest lateral spines on the abdomen are on the eighth and ninth segments (**Fig. 3.2.566**). There is almost no pattern on the abdomen at all, except for small dark spots along the anterior margin of the seventh abdominal segment. Total length of final instar: c. 38 to 39 mm.

.....*Neuraeschna harpya* Martin, 1909
(Peru, Venezuela, French Guiana, Guyana, Surinam, Amazonas).

- The lateral spine on the seventh abdominal segment is about as long as those on the eighth and ninth. There is a pattern on the abdomen, which forms a

narrow mid-dorsal stripe bordered by a pale area and a pair of diffuse stripes. The dorsolateral margins are also darkened (**Fig. 3.2.436**).

..... *Neuraeschna costalis* (Burmeister, 1839)
(Ecuador, Venezuela, Guyana, French Guiana, Surinam, Amazonas, São Paulo).
Syn: *Aeshna costalis* Burmeister, 1839; *Neuraeschna ferox* Erichson, 1848;
Neuraeschna costalis var. *hyalinata* Belle, 1989; *Neuraeschna costalis* var.
marginata Belle, 1989.

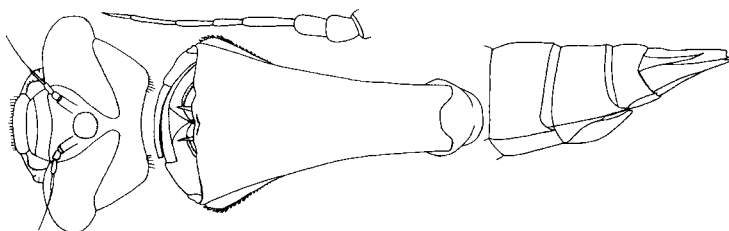


Fig. 3.2.566 *Neuraeschna harpya* female larva: head in dorsal view (left), labium in ventral view (lower center), antenna in dorsal view (upper center), and apex of the abdomen (right). Based on Belle (1989).

Key to the species of adult *Staurophlebia* in South America, based mainly on the male

Information for the key was provided by Geijskes (1959). There is insufficient information available to prepare a key to the larvae.

1. The occipital triangle is pale green, yellow, or reddish. The rear of the head is black, but its sides along the eye margin are pale in most species. The wing membrane is white or grayish.2
- The occipital triangle and back of the head are black. The wing membrane is dark gray (**Fig. 3.2.567**).4

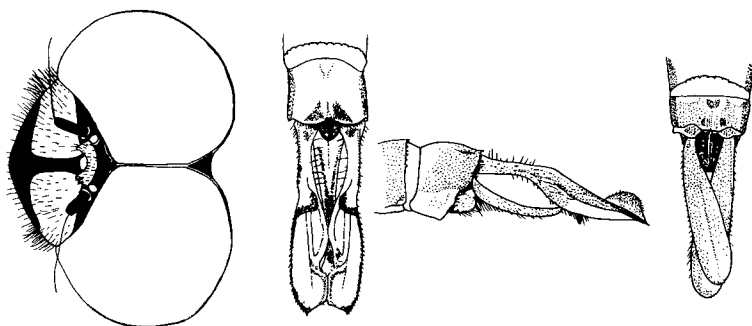


Fig. 3.2.567 *Staurophlebia wayana* (left to right): head in dorsal, apex of the male abdomen in dorsal and lateral view, and apex of the female abdomen in dorsal view. Based on Geijskes (1959).

2. The male inferior appendage reaches only about 1/3 the length of the superior appendix. The wing membrane is white. The superior appendage of the male has a low apical crest (**Fig. 3.2.568**). Total length: 75 to 76 cm. Hind wing length: 53 mm.

.....*Staurophlebia gigantula* Martin, 1909
(Venezuela, Peru, Amazonas).

- The male inferior appendage reaches 2/3 the length of the superior appendage (**Fig. 3.2.569**).3

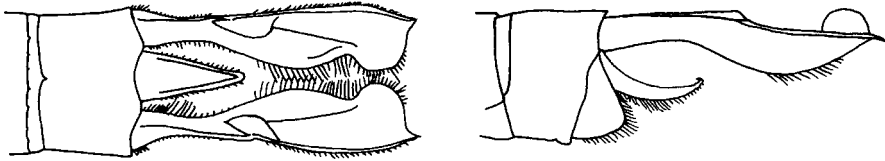


Fig. 3.2.568 *Staurophlebia gigantula*: apex of the male abdomen in dorsal (left) and lateral view (right). Based on Geijskes (1959).



Fig. 3.2.569 *Staurophlebia bosqi* male (left to right): veins in the nodal area of the fore-wing, superior anal appendage on the right side in dorsal view, and the apex of the male abdomen in lateral view. Based on Navás (1927).

3. The total length is 80 mm; the hind wing is 59 mm long. The elevated apical crest of the male superior appendage is high; its apical edge is vertical. The end of the superior appendage is triangular and pointed (**Fig. 3.2.569**).

.....*Staurophlebia bosqi* Navás, 1927
(Argentina, São Paulo).

- The total length is 85 to 96 mm. The hind wing is 58 to 64 mm. The occipital part of the head is black, but the lateral part is green. The superior crest of the male superior appendage is low, viewed laterally; its apical edge is vertical, and its apex is very broad (**Fig. 3.2.570**). The thorax is dark reddish brown, and that of the male has lateral greenish markings. The abdomen is dark reddish brown, and the last two segments of the female are darker.

.....*Staurophlebia reticulata* (Burmeister, 1839)
(Central America, Trinidad, Colombia, Ecuador, Peru, Venezuela, Guyana, French Guiana, Surinam, Uruguay, Argentina, Paraguay, Mato Grosso). Syn: *Staurophlebia platyura* Navás, 1920; *Aeschna gigas* Rambur, 1842; *Staurophlebia magnifica* Brauer, 1865. Three subspecies have been described: *Staurophlebia reticulata reticulata* Burmeister, 1839; *Staurophlebia reticulata guatemalteca* Walker, 1915; and *Staurophlebia reticulata obscura* Walker, 1915.

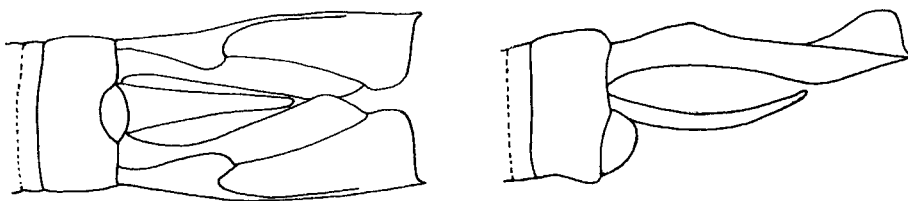


Fig. 3.2.570 *Staurophlebia reticulata* male: apex of the abdomen in dorsal and lateral view. Based on Navás (1920), referred to as *Staurophlebia platyura*.

4. There is a black line at the base of the labrum and another between the clypeus and frons. The horns of the vertex are low and blunt. The second antennal segment is not especially long. The inferior appendage of the male is $\frac{2}{3}$ the length of the superior. Viewed laterally, the apical crest of the superior appendage is very high, and its anterior edge is vertical (**Fig. 3.2.433**). Total length: 82 to 96 mm; hind wing length: 55 to 63 mm. The synthorax is glossy dark brown with yellowish wing bases. The abdomen is dark reddish brown.

.....*Staurophlebia auca* Kennedy, 1937
(Peru, Ecuador, Venezuela, French Guiana, Surinam).

- There is only a black spot at the base of the labrum and a fine brown line between the clypeus and frons. The horns of the vertex are prominent and sharply pointed. The second segment of the antenna is especially long. The male inferior appendage is half the length of the superior. The apical crest of the superior appendage, viewed laterally, is low and semi-circular (**Fig. 3.2.567**). Total length: 83 to 85 mm. Hind wing length: 57 to 60 mm.

.....*Staurophlebia wayana* Giejskes, 1959
(Venezuela, Surinam).

Gomphidae

Key to the genera of adults in South America

Information for the key was provided by Williamson (1918a, b, c), Needham (1940), Fraser (1947a, b), Smith and Pritchard (1963), and Belle (1972a; 1979a; 1988a, b; 1995a; 1996).

1. The second primary antenodal cross vein in the hind wing is located closer to the first primary antenodal cross vein than to the nodus (**Fig. 3.2.571**).2
- The second primary antenodal cross vein in the hind wing is located equidistant from the first primary antenodal cross vein and the nodus or closer to the nodus (**Fig. 3.2.572**).4

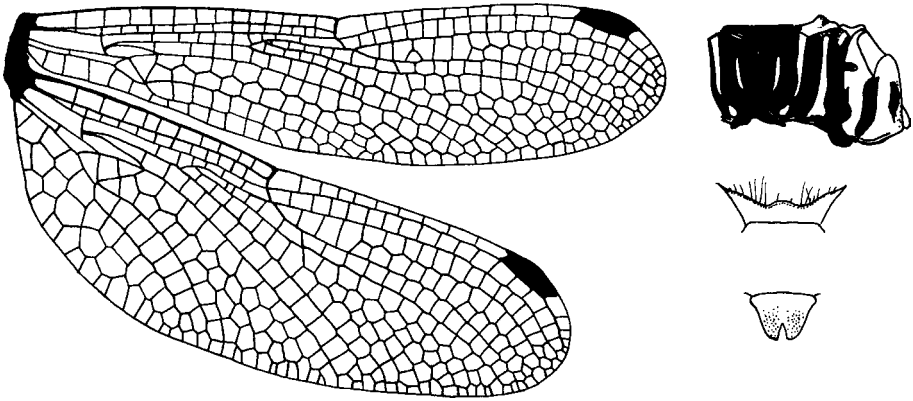


Fig. 3.2.571 *Anomalophlebia nitida* female: fore and hind wing (left), the color pattern on the lateral surface of the thorax (upper right), dorsal view of the occipital plate (middle right), and ventral view of the vulvar lamina (lower right). Based on Belle (1995a).

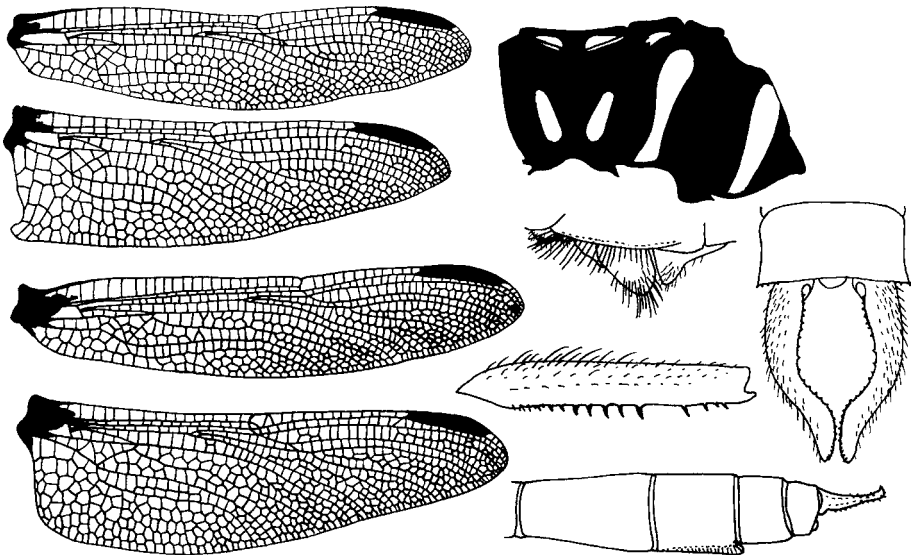


Fig. 3.2.572 *Melanocacus interioris*: fore and hind wing of a male (upper left) and a female (lower left), diagram of the color pattern on the synthorax (upper right), genitalia on the second abdominal segment of a male (below synthorax), hind femur in lateral view (below genitalia), apex of a male abdomen in dorsal (middle right) and lateral view (lower right). Based on Belle (1986a).

2. The occipital plate supports a ridge. Veins Cu_1 and Cu_2 in the hind wing run parallel. There is no brace vein posterior to the pterostigma. In the fore-wing, the anterior sector of the arcus is closer to Cu than to $R+M$, and the anterior branch of the median fork in the fore-wing is strongly arched anteriorly. The basal subcostal vein is absent, and there is no anal loop in the hind wing. The triangle in the hind wing is divided into two cells, but the other triangles are not crossed. The length of the pterostigma is 2 to 3 times its width (**Fig. 3.2.571**). The female lacks auricles. Total length of female: c. 38 mm. Length of female abdomen with appendages: c. 29 mm. Hind wing length of female: c. 24 mm. Pterostigma length on fore-wing along costa: c. 2.2 mm. A male in this genus has not been described.

.....*Anomalophlebia* Belle, 1995

The only species described in this genus is *Anomalophlebia nitida* Belle, 1995, known only from Venezuela. It is brown with whitish and bluish green on the head and yellow markings on the thorax and abdomen.

- Veins Cu_1 and Cu_2 in the hind wing diverge considerably toward the posterior margin of the wing (**Fig. 3.2.573**). There is no occipital place, but there is a ridge on the occiput that is thicker in the middle.3

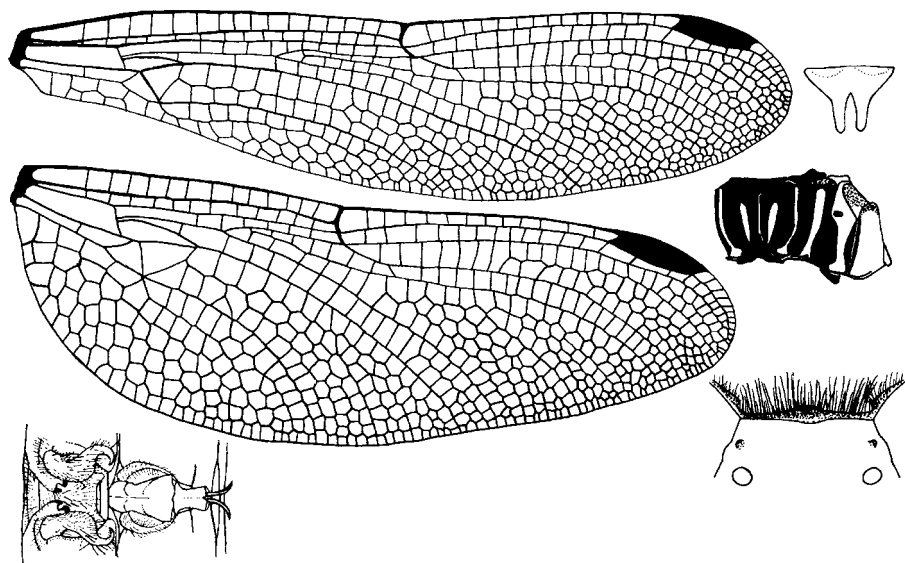


Fig. 3.2.573 *Praeviomphus proprius*: fore and hind wing of a female (left), color pattern on the lateral surface of the thorax of a female (middle right), dorsal view of part of the head (lower right), genitalia of a pharate male on the second abdominal segment in ventral view (lower left), and ventral view of the vulvar lamina (upper right). Based on Belle (1995a) and Carvalho (2000).

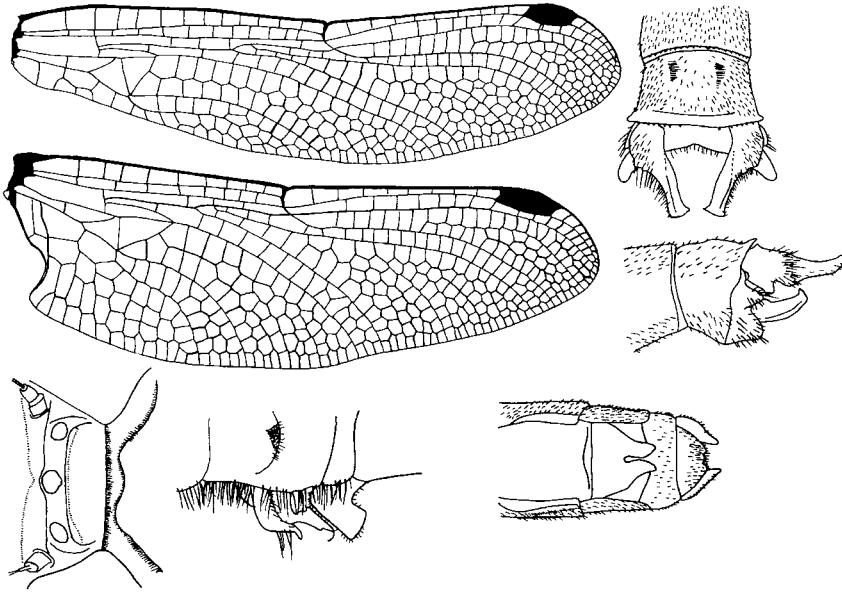


Fig. 3.2.574 *Neogomphus bidens*: fore and hind wing of a male (upper left), vertex of head with the ocellar triangle and bases of the antennae of a female (lower left), genitalia on the second abdominal segment of the male in lateral view (lower left center), apex of the male abdomen in dorsal (upper right) and lateral view (middle right), and the apex of the female abdomen in ventral view (lower right). Based on Schmidt (1941a).

3. The pterostigma is more than three times as long as wide. The subtriangle or triangle in the hind wing is sometimes crossed. There are about five or six paranal cells in the hind wing and about 16 antenodal cross veins in the forewing of the female. The basal subcostal vein is always absent (**Fig. 3.2.573**). The anterior hamule of the male genitalia is enlarged and developed into two black lobes at the apex.

.....*Praeviogomphus* Belle, 1995

The only species described in this genus is the rare *Praeviogomphus proprius* Belle, 1995, known only from the state of Rio de Janeiro, Brazil. The genus is so similar to *Neogomphus* that its validity is in doubt, and Carvalho (2000) speculated that the only nominal species may actually be synonymous with *Neogomphus elegans*.

- The pterostigma is less than three times as long as wide. The triangle, subtriangle, and supratriangle are usually free. There are four paranal cells in the hind wing and about 12 antenodal cross veins in the forewing (**Fig. 3.2.574**).

.....*Neogomphus* Selys, 1857..pp. 538

4. There is one intermedian cross vein in the hind wing, a brace vein posterior to the pterostigma, and no basal subcostal cross vein. The occipital plate of the male bears a ridge. In the hind wing of the male, the second anal interspace is shorter than the first. In the female, the vulvar lamina does not extend beyond the mid-length of the ninth sternite (**Fig. 3.2.575**), and vestiges of auricles are distinct.

.....*Erpetogomphus* Selys, 1857

In addition to about 15 North and Central American species, there is one species known from South America, *Erpetogomphus sabaleticus* Williamson, 1918, known from Panama, Colombia, and Venezuela. It has been recommended for consideration as an endangered species in Venezuela (DeMarmels, 1999).

- The hind wing has at least two intermedian cross veins (**Fig. 3.2.572**).5

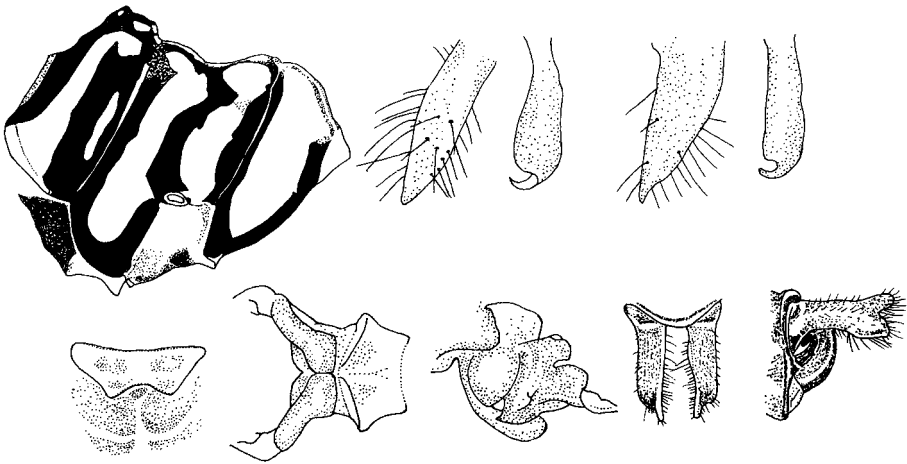


Fig. 3.2.575 *Erpetogomphus sabaleticus* (upper row, left to right): color pattern on the lateral surface of the synthorax of a male and the anterior and posterior hamules in anterolateral and in lateral view, and (lower row, left to right): the vulvar lamina in dorsal view, fourth segment of the penis in dorsal and lateral view, and the apex of the abdomen of a male in dorsal and lateral view. Based on Garrison (1994).

5. The triangle in the hind wing is crossed, or that triangle is not crossed and the wings are partially colored (**Fig. 3.2.572**).6

- The triangle in the hind wing is usually not crossed, and the wings are hyaline (**Fig. 3.2.576**).18

6. Vein Rs has a nearly symmetrical fork since the vein is slightly bent anteriad at the fork (**Fig. 3.2.572**).7

- Vein Rs has no fork or the fork is asymmetrical since Rs continues on a straight line distal to the fork while the posterior branch bends posteriad at the fork (**Fig. 3.2.577**).8

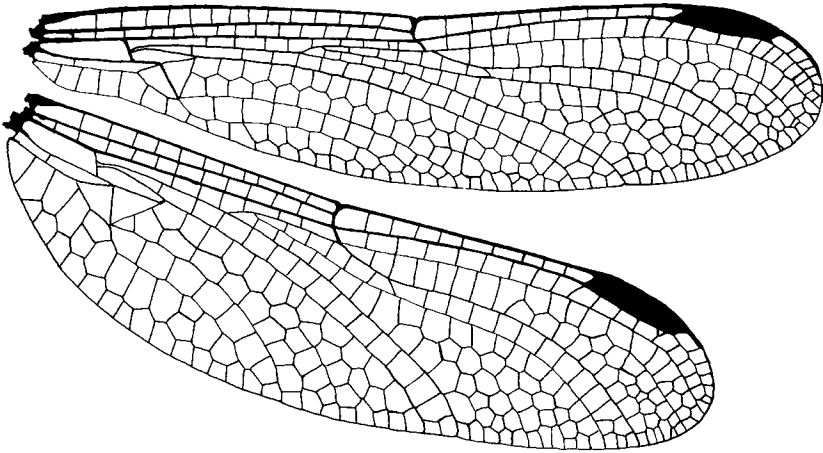


Fig. 3.2.576 Fore and hind wing of a female *Cyanogomphus demerarae*. Based on Belle (1966b).

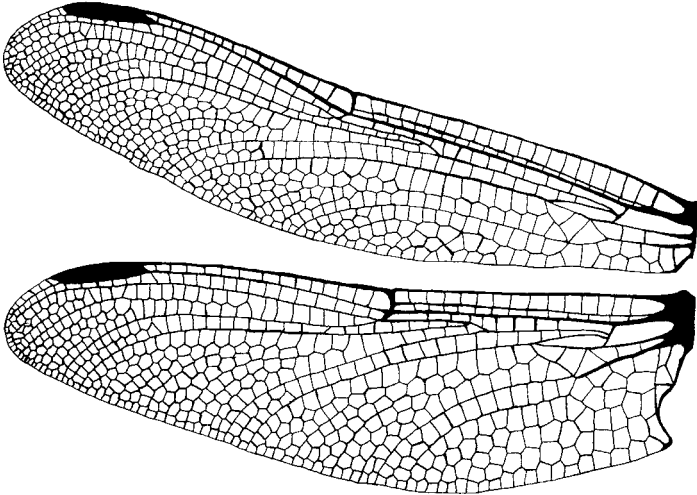


Fig. 3.2.577 Fore and hind wing of *Zonophora calippus*. Based on Belle (1963).

7. The bases of the wings have brown patches. On the hind femur, the length of the longest spines in the outer row is less than half the diameter of the femur (**Fig. 3.2.572**).

.....*Melanocacus* Belle, 1986..p. 541

- The wings are entirely hyaline. On the hind femur, the length of the longest spines in the outer row is greater than half the diameter of the femur (**Fig. 3.2.2**).

..... *Cacoides* Cowley, 1934

Only one species remains in this genus at the present time: *Cacoides latro* (Erichson, 1848) from Guyana, French Guiana, Surinam, Venezuela, and Brazil. Syn: *Ictinus latro* Erichson, 1848.

8. There is a strong spine on the subalar carina near the base of the hind wing, and the anal loop in the hind wing is open on the basal side (**Fig. 3.2.577**).9

- There is no spine on the subalar carina near the base of the hind wing; its angle is obtuse (**Fig. 3.2.578**).10

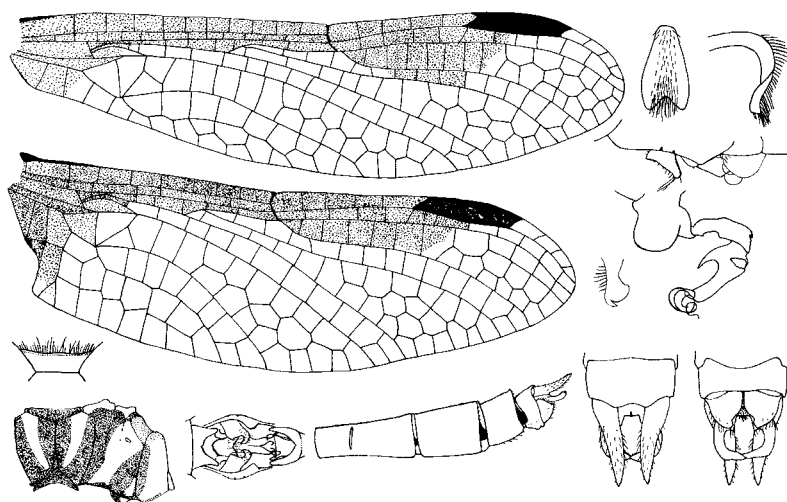


Fig. 3.2.578 *Progomphus perithemoides* male: fore and hind wing (upper left), occipital plate (lower middle left), diagrammatic depiction of the color pattern on the pterothorax (lower left), genitalia on the second abdominal segment in ventral (lower left center) and enlarged in lateral view (upper middle right), penis guard in anterior (upper right center) and lateral view (upper right), penis (lower middle right), anterior hamule in lateral view (left of penis), apical segments of the abdomen in lateral view (lower center), and its apex in dorsal (lower right center) and ventral view (lower right). Based on Belle (1980a).

9. The subtriangle of the fore-wing is crossed. There are two triangular peaks on the vertex (**Fig. 3.2.579**). The male of the only known species is black with a three pair of yellow spots, on the frons, collar, and anterior part of the synthorax, and three pairs of white spots, on the third, fourth, and fifth abdominal segments. The wings are hyaline with a blackish brown tinge from the base to the arculus and the base of vein Cu. The total length of the male is about 61 mm; the

abdomen is about 45 mm, and the hind wing is about 38 mm. The pterostigma is about 6 mm long. The female has not been described.

.....*Mitragomphus* Needham, 1943

The only species described in this genus is *Mitragomphus ganzanus* Needham, 1943, known only from Pará, Brazil.

- The subtriangle of the fore-wing is not crossed. The anal loop is well developed with three or more cells. The hind wind is usually more than 45 mm long (**Fig. 3.2.577**).

.....*Zonophora* Selys, 1954..p. 542

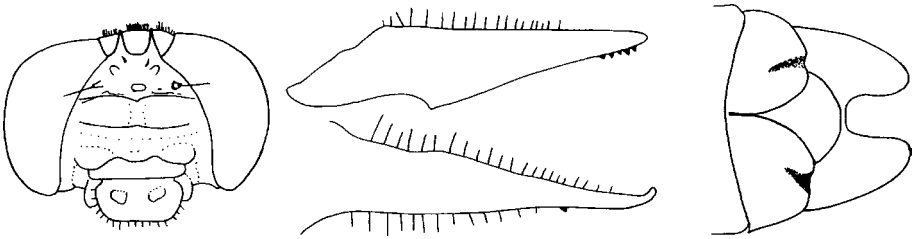


Fig. 3.2.579 *Mitragomphus ganzanus* male (left to right): head in frontal view, superior anal appendages in dorsal and lateral view, and the ventral anal appendage in ventral view. Based on Needham (1943).

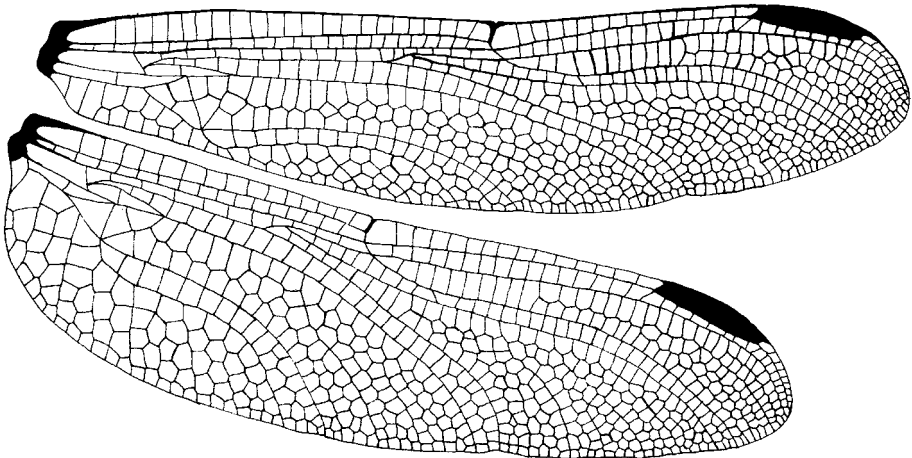


Fig. 3.2.580 *Aphylla dentata* male: Fore and hind wing Campion (1920) and Belle (1946b).

10. In the hind wing of the male, the anal triangle does not extend all of the way to the anal angle of the wing (**Fig. 3.2.578**). The supratrangles of both sexes are usually uncrossed. To identify aberrant female specimens, careful attention should be paid to descriptions in subsequent couplets.11

- In the hind wing of the male, the anal triangle reaches the anal angle of the wing (**Fig. 3.2.580**). In the wings of both sexes, the supratrangles are crossed, or, if not, the female vulvar lamina extends beyond the mid-length of the ninth sternite, and the nodus and pterostigma are separated by a distance less than three times the length of the pterostigma measured along the costa.13

11. In the male, the posterior genital hamule is wide at the base and has a row of denticles or a chitinized ridge on its anterior side (**Fig. 3.2.578**). In the female, there are no traces of auricles, and the nodus and pterostigma are separated by a distance more than three times the length of the pterostigma measured along the costa. The vulvar lamina does not extend beyond the mid-length of the ninth sternite.

.....*Progomphus* Selys, 1854..p. 551

- In the male, the base of the posterior genital hamule is not wide at the base, and it does not have a row of denticles or a chitinized ridge on its anterior side. In the hind wing of the male, the first anal interspace is shorter than the second (**Fig. 3.2.581**). In the female, the nodus and pterostigma are usually separated by a distance of more than three times the length of the pterostigma measured along the costa; if not, then the vulvar lamina extends far beyond the mid-length of the ninth sternite.12

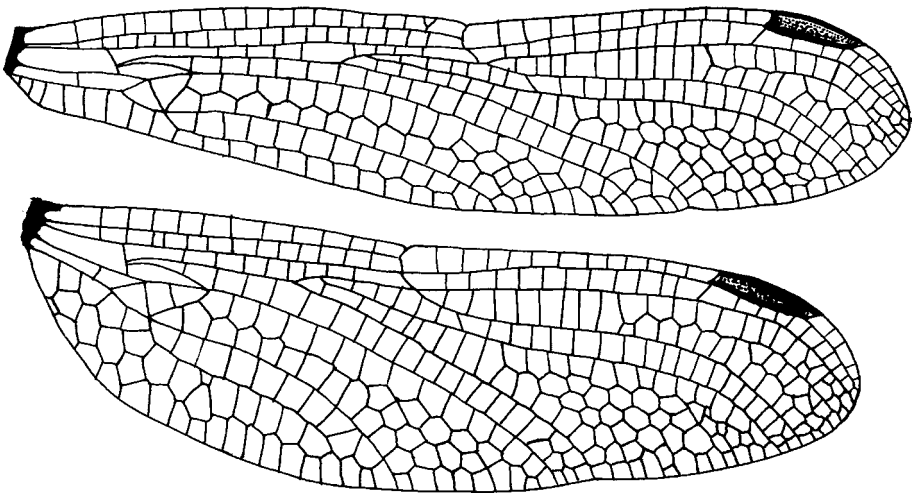


Fig. 3.2.581 Fore and hind wing of a female *Desmogomphus paucinervis*. Based on Belle (1970a).

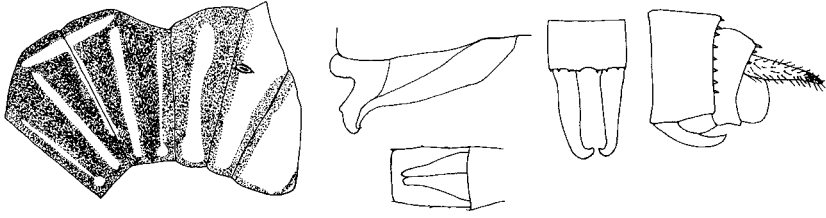


Fig. 3.2.582 *Diaphlebia angustipennis* (left to right): diagram of the color pattern on the thorax of a male, lateral profile of the male genitalia on the second abdominal segment (above), vulvar lamina of a female (below), and apex of the abdomen of a male in dorsal and lateral view. Based on St. Quentin (1973).

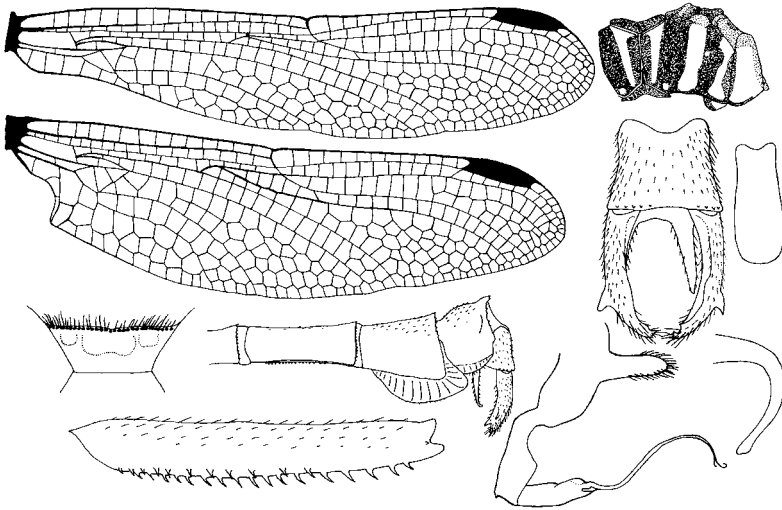


Fig. 3.2.583 *Peruviogomphus pearsoni* male: fore and hind wing (upper left), occipital plate (middle left), outer surface of the hind femur not showing the row of spines on the inner side (lower left), diagrammatic view of the color pattern on the pterothorax (upper right), apical segments of the abdomen (center below wings), dorsal view of the tenth abdominal segment with appendages (middle right center), penis guard in anterior (middle right) and lateral view (lower right), and the penis (lower right center). Based on Belle (1979b).

12. Veins Cu_1 and Cu_2 in the hind wing are parallel or diverge only slightly. Posterior to vein Cu_2 , there is only one row of cells. The inner posterior margin of the male hind wing is evenly convex (**Fig. 3.2.581**).

.....*Desmogomphus* Williamson, 1920..p. 588

- Veins Cu_1 and Cu_2 in the hind wing are obviously divergent. Posterior to vein Cu_2 , there are two or three rows of cells. The inner posterior margin of the male hind wing is concave or straight. Usually, the apex of the penis rests between two halves of a vesicle. In the female, the vulvar lamina extends far beyond the mid-length of the ninth sternite (**Fig. 3.2.582**), and the nodus and pterostigma are separated by a distance less than three times the length of the pterostigma measured along the costa.

.....*Diaphlebia* Selys, 1854..p. 589

13. There is a dorsal rim at the apex of the tenth abdominal segment (**Fig. 3.2.580**). 14

- There is no dorsal rim at the apex of the tenth abdominal segment (**Fig. 3.2.583**). 15

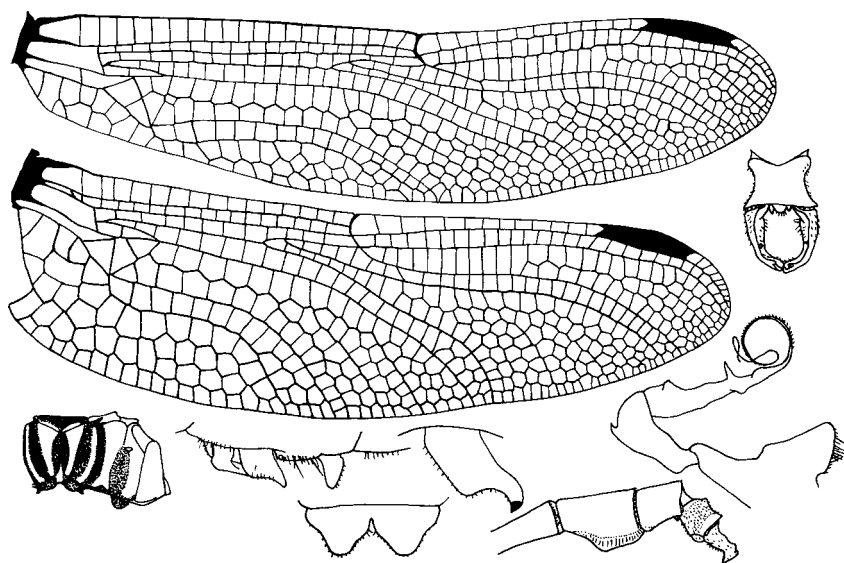


Fig. 3.2.584 *Phyllocycla medusa*: fore and hind wing of a male (above left), lateral view of the thorax showing the color pattern of a male (lower left), lateral view of the male genitalia on the ventral side of the second abdominal segment (lower left center), ventral view of the right posterior hamule (middle below wings), apical segments of the male abdomen in lateral view (lower right center), dorsal view of the apex of the male abdomen with caudal appendages (right of the wings), penis in lateral view (lower right), and vulvar lamina in ventral view (lower center). Based on Belle (1988a).

14. The spines located on the anterior surface of the hind femur are never longer than about $1/6$ of the femoral diameter. Usually, the apex of the penis rests on a transverse lamella, which has a median V-shaped incision at the apex. Vein A_2 runs directly to the margin (**Fig. 3.2.580**). In the female, the vulvar lamina does

not extend beyond the mid-length of the ninth sternite. In life, the abdominal sternites are reddish, at least on the apical segments. The supratrangles are usually crossed, but in exceptional individuals, they may not be.

.....*Aphylla* Selys, 1854..p. 590

- On the hind femur of the female, the spines in the anterior row are about 1/4 of the femoral diameter. The appendages on the penis are flagellar and bear a row of microscopic serrae along their outer borders (**Fig. 3.2.584**). Apparently, the supratrangles are always crossed. In life, the abdominal sternites of the female are brown without a reddish tinge. Vein A_2 is usually angulate and distinctly convergent with A_3 .

.....*Phyllocycla* Calvert, 1948..p. 602

15. All subtriangles and the triangle in the fore-wing are uncrossed, but the triangle in the hind wing is crossed once. The length of the pterostigma of the fore-wing, measured along the costa, is not more than 1/3 as long as the distance from the nodus to the pterostigma. The anal border of the hind wing forms two prominent angles, and proximal to the first angle, there is a row of denticles along the wing margin. The dorsal surface of the male thorax has a dark anterior marking and a contiguous posterior one with three branches forming a broad median stripe and also a pair of dorsolateral stripes not connected to the anterior marking (**Fig. 3.2.583**).

.....*Peruviogomphus* Klots, 1944..p. 617

- All triangles and subtriangles are usually crossed, but the subtriangle in the hind wing may sometimes not be crossed. The length of the pterostigma of the fore-wing, measured along the costa, is more than 1/3 as long as the distance from the nodus to the pterostigma.16

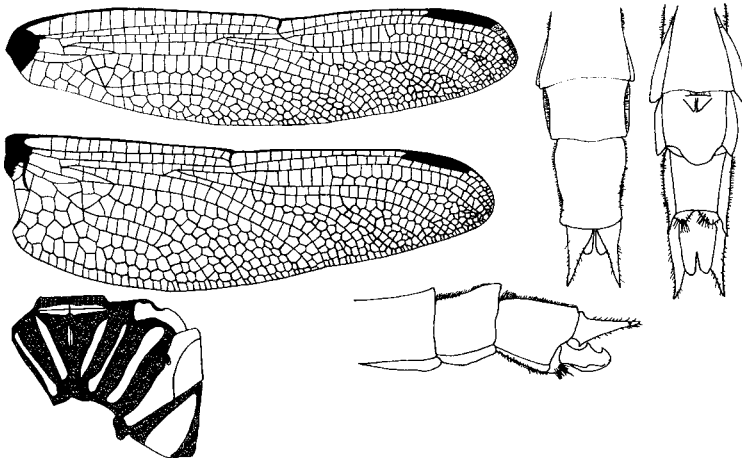


Fig. 3.2.585 *Gomphoides infumatus* male: fore and hind wing (upper left); diagram of the color pattern on the synthorax (lower left); apex of the abdomen in dorsal (upper right center), ventral (upper right), and lateral view (lower right). Based on Ris (1911c).

16. There are two very strong branches on the robust inferior anal appendage of the male, and there is a dorsal tooth or spur on each branch (**Fig. 3.2.585**). The tenth abdominal segment is stout and longer than the ninth. The vulvar lamina does not reach beyond the mid-length of the ninth abdominal segment.

.....*Gomphoides* Selys, 1854..p 620

- The inferior anal appendage of the male is not robust and is sometimes vestigial, and if branches are present, they lack a dorsal tooth or spur. The vulvar lamina is divided for almost its entire length, and both branches are equal in length to the ninth abdominal segment, or, if not, then the tenth abdominal segment of the female is shorter than the ninth (**Fig. 3.2.586**). 17

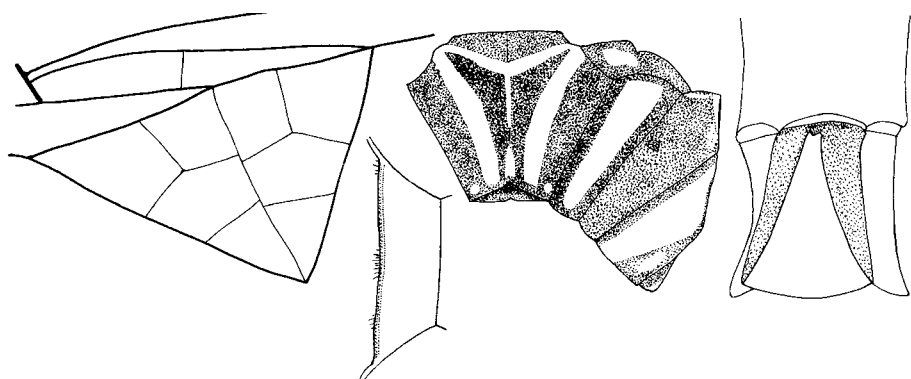


Fig. 3.2.586 *Idiogomphoides ictinius* female (left to right): the area of the arcus and triangle in the hind wing, occipital plate in dorsal view, diagram of the color pattern on the synthorax, and the vulvar lamina. Based on St. Quentin (1967) and Belle (1995a).

17. There are two internal subapical teeth on the posterior genital hamule. The eighth abdominal segment lacks any lateral foliate extension. The anal triangle in the hind wing, at least of the male, consists of six to eight cells. The vulvar lamina is divided for almost its entire length, and both branches are equal in length to the ninth abdominal segment (**Fig. 3.2.586**).

.....*Idiogomphoides* Belle, 1984..p. 621

- There is one apical tooth on the posterior genital hamule. The eighth abdominal segment has at least narrow lateral dilations. The anal triangle in the hind wing of the male usually consists of four cells (**Fig. 3.2.587**). The vulvar lamina is undivided and does not reach past the midlength of the ninth abdominal segment. The ninth abdominal segment of the female is longer than the tenth.

.....*Phyllogomphoides* Belle, 1970..p. 622

18. An occipital plate with a posterior ridge is present (**Fig. 3.2.576**). 19

- The posterior part of the head is evenly rounded and lacks a complete transverse ridge; if a ridge is present at all, it is discontinuous in the middle. The occipital surface may appear deformed, especially in females, which are sometimes sexually dimorphic to facilitate mating (**Fig. 3.2.588**). 20

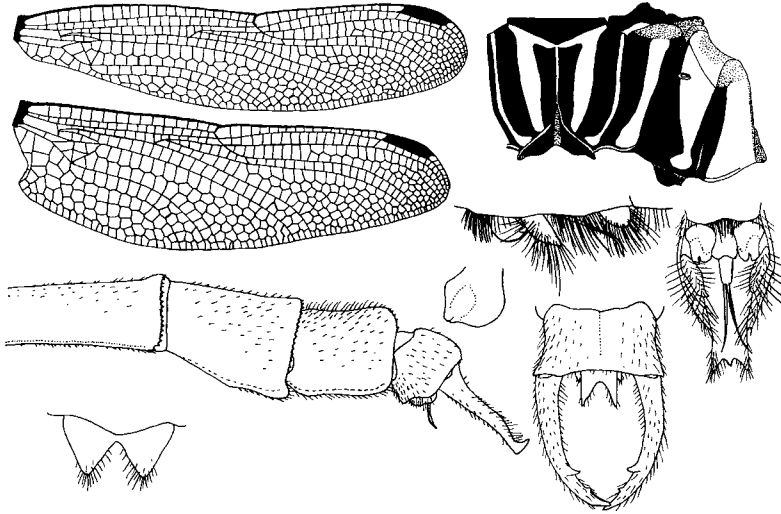


Fig. 3.2.587 *Phyllogomphoides brunneus*: fore and hind wing (upper left); diagram pattern on the thorax of a male where the solid dark color is brown, the unshaded surfaces yellow, and the stippled surfaces yellowish brown (upper right); apical segments of the male abdomen in lateral view (lower middle left); apex of the male abdomen in dorsal view (lower right center), male genitalia on the second abdominal segment in ventral (middle right) and lateral view (right of center); apex of an anterior genital hamule (center below genitalia), and vulvar lamina of an allotype female (lower left). Based on Belle (1981).

19. The hind tibia of the male has an anterior row of spines that are fairly long and not thickened at the base. No spines are present near the foramen in the posterior surface of the head. There is an anal triangle in the hind wing of the male. There are two or three rows of cells behind vein Cu_2 in the fore-wing. The female vulvar lamina on the ninth abdominal segment does not extend beyond the midlength of the segment (**Fig. 3.2.576**).

.....*Cyanogomphus* Selys, 1873..p. 642

- The hind tibia of the male has an anterior row of spines that are short and markedly thickened at the base. The female vulvar lamina on the ninth abdominal segment extends beyond the midlength of the segment (**Fig. 3.2.589**).

.....*Tibiagomphus* Belle, 1992..p. 649

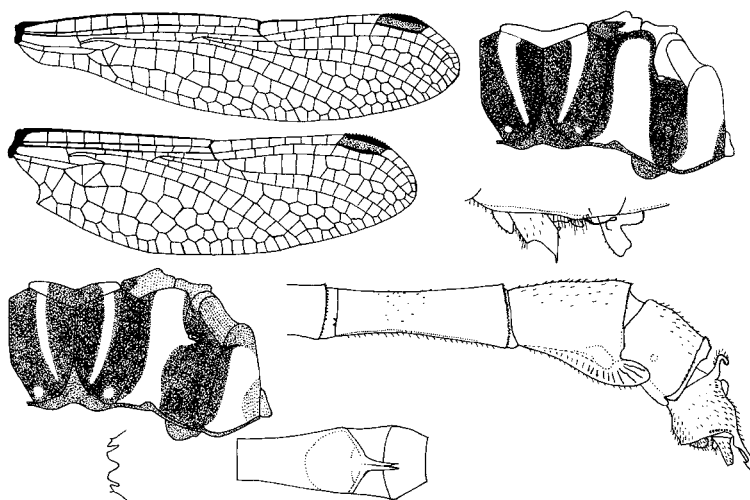


Fig. 3.2.588 *Archaeogomphus densus*: fore and hind wing of a male (upper left), diagram of the color pattern on the synthorax of a male (upper right) and a female (lower middle left), male genital organs on the second abdominal segment in lateral view (upper middle right), apical segments of the male abdomen in lateral view (lower middle right), dorsal margin of the occipital foramen of a female in posterior view (lower left), vulvar lamina in ventral view (lower center). Based on Belle (1982a).

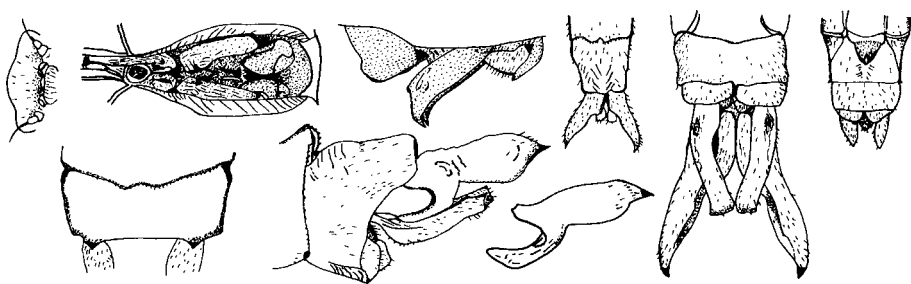


Fig. 3.2.589 *Tibiagomphus noval* (above, left to right): anterior part of the head in dorsal view, male genital organs on the second abdominal segment in ventral and lateral view, apex of the abdomen of a male in dorsal and enlarged in ventral view, apex of the female abdomen in ventral view, and (below, left to right): apical segment of the abdomen of a female head in dorsal view, apex of the male abdomen in lateral view, and its superior anal appendage in lateral view. Based on Rodrigues Capitulo (1984).

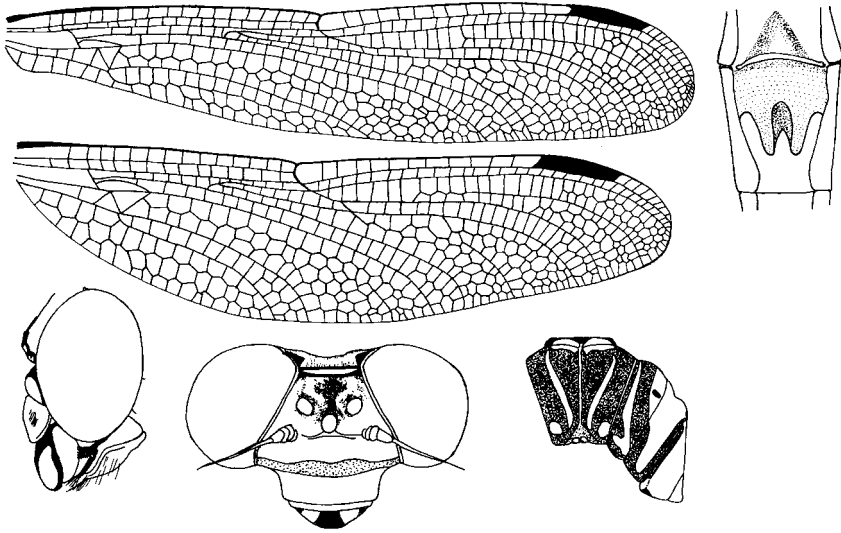


Fig. 3.2.590 *Epigomphus obtusus* female: fore and hind wing (upper left), head in lateral (lower left) and anterior view (lower center), diagram of the color pattern on the synthorax (lower right), and the vulvar lamina on the ninth abdominal segment of the female (upper right). Based on Fraser (1947b).

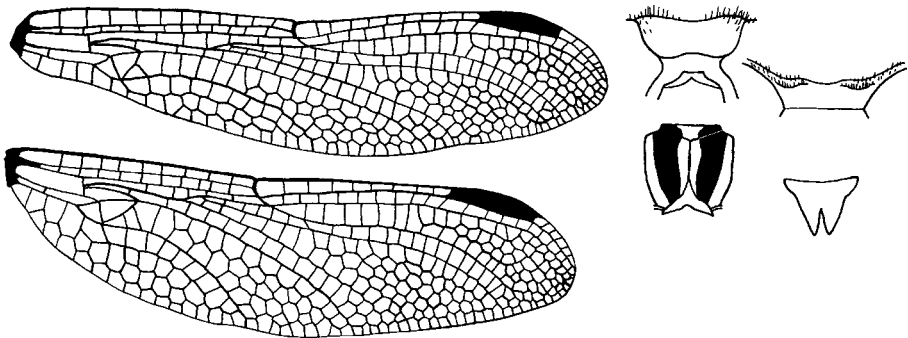


Fig. 3.2.591 *Brasiliogomphus uniseries* female: fore and hind wing (left), dorsal view of the central part of the head (upper right center), dorsal view of the occipital plate (upper right), the color pattern on the dorsal surface of the pterothorax (lower right center), and ventral view of vulvar lamina (lower right). Based on Belle (1995a).

20. There is no basal subcostal cross vein. There is no anal triangle in the hind wing of the male. The superior anal appendage of the male is not forked. The vulvar lamina bears a pair of slender, tapering branches running close to each other from the base to apex of the ninth sternite (**Fig. 3.2.588**).

.....*Archaeogomphus* Williamson, 1919..p. 652
 - A basal subcostal cross vein is present (**Fig. 3.2.590**).21

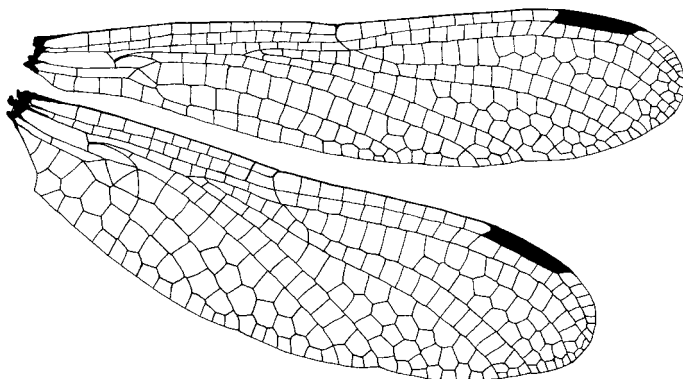


Fig. 3.2.592 Fore and hind wing of a male *Agriogomphus sylvicola*. Based on Belle (1966b).

21. There are usually at least two cubito-anal cross veins in each wing. The superior anal appendage of the male is well developed but always lacks a long mediobasal spine that is directed ventrad. The tenth abdominal segment of the male is not notched on the lateral margin (**Fig. 3.2.590**).

.....*Epigomphus* Hagen in Selys, 1854..pp. 657
 - There is usually only one cubito-anal cross vein present (**Fig. 3.2.591**). A brace vein is present posterior to the pterostigma.22

22. An occipital crest is present but interrupted in the middle (**Fig. 3.2.591**). The anal border of the hind wing of the female is evenly curved and does not form any angle. The dark markings on the thorax include two thick dorsolateral stripes that extend from the anterior margin to the posterior margin of the mesonotum, and are nowhere contiguous. The dorsal margin of the foramen magnum is U-shaped. The genus was described from a single female specimen.

.....*Brasiliogomphus* Belle, 1995
 The only species known from this genus is *Brasiliogomphus uniseriis* Belle, 1995, known from the state of São Paulo, Brazil. Its total length is about 37 mm; its abdomen with appendages is about 29 mm, and its hind wing is 26 mm long. The pterostigma in the hind wing is about 3.8 mm. The female is predominantly yellow with brown stripes on the thorax and first six abdominal segments. It also has black spines on the posterior margin of the tenth abdominal segment.

- The posterior part of the occiput is evenly rounded off. A pair of spines is present near the foramen in the posterior surface of the head. There is no anal triangle in the hind wing of the male. In the trigonal space, there is only a single row of cells. The vulvar lamina reaches only to the midlength of the ninth sternite (**Fig. 3.2.592**).

..... *Agriogomphus* Selys, 1869..p. 650

Key to the genera of Gomphidae larvae in South America

Information for the key was provided by Needham (1944), Belle (1966a, 1970a, 1992a), and Carvalho (2000). The genus *Diaphlebia* must be omitted from the key until adequate descriptions of the larvae become available.

1. All tarsi consist of 2 segments (**Fig. 3.2.593**).2

- The fore and middle tarsi consist of two segments, while the hind tarsus consists of three. The labrum is flat. The body is stout (**Fig. 3.2.594**). The total length of a full-grown larva is at least 20 mm.4

2. The labium is spoon-shaped, its lateral lobes are wide to the end and concave. The body is not notably widened and is delicate (**Fig. 3.2.593**). Maximum total length: 15 mm.

..... *Archaeogomphus* Williamson, 1919..p. 652

- The labium is nearly flat, and the body is robust (**Fig. 3.2.595**). 3

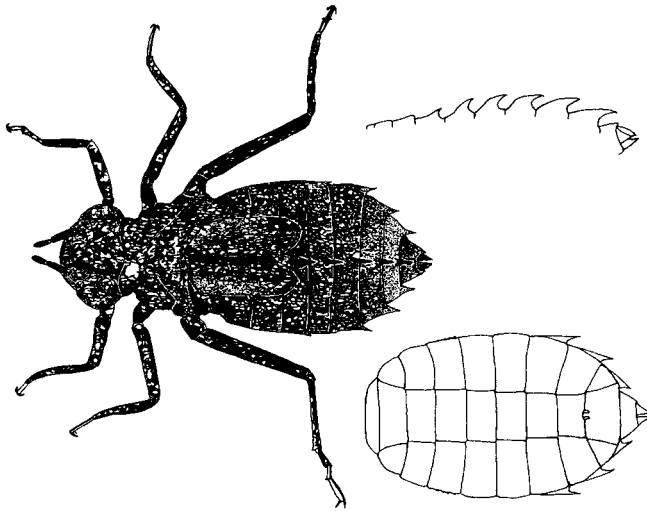


Fig. 3.2.593 *Archaeogomphus furcatus* larva: habitus based on an exuvia of a female (left), dorsal profile of the abdominal segments showing the dorsal spines of a male larva in lateral view (upper right), and the ventral surface of the abdomen of a female larva (lower right). Based on Belle (1992a).

3. The lateral spines on the seventh through ninth abdominal segments are nearly equal in size. The abdomen is somewhat lens shaped, the tenth abdominal segment being completely enclosed laterally within the prolongations of the ninth (Fig. 3.2.595).

..... *Cacoides* Cowley, 1934

Only one species remains in this genus at the present time: *Cacoides latro* (Erichson, 1848) from Guyana, French Guiana, Surinam, Venezuela, and Brazil. Syn: *Ictinus latro* Erichson, 1848.

- The lateral spine on the seventh abdominal segment is by far the largest, and it has a dorsal keel. The abdomen is somewhat roof-shaped (Fig. 3.2.596).

..... *Melanocacus* Belle, 1986..p. 541

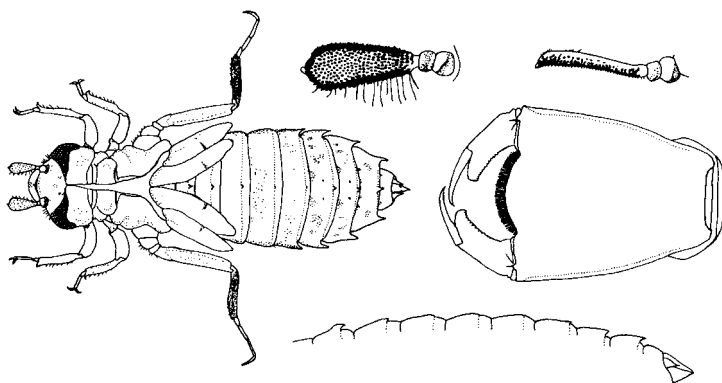


Fig. 3.2.594 *Progompheus geijskesi* larva: habitus from exuvium, showing the exit tear in the thorax (upper left); labium in ventral view (middle right); antenna in dorsal (upper center) and lateral view (upper right); dorsal outline of the abdomen (lower right). Based on Belle (1972b).

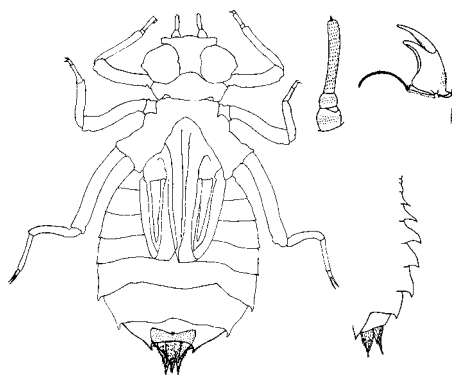


Fig. 3.2.595 *Cacoides latro* larva: habitus (left), antenna (upper center), anterior margin of the prementum with one labial palp (upper right), and a dorsal and apical profile of the abdomen (lower right). Based on Belle (1970a).

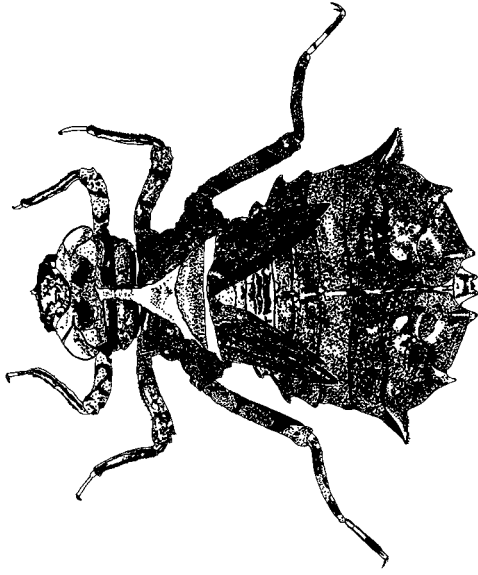


Fig. 3.2.596 Habitus of a *Menalocacus mungo* larva (left). Based on Belle (1970a).

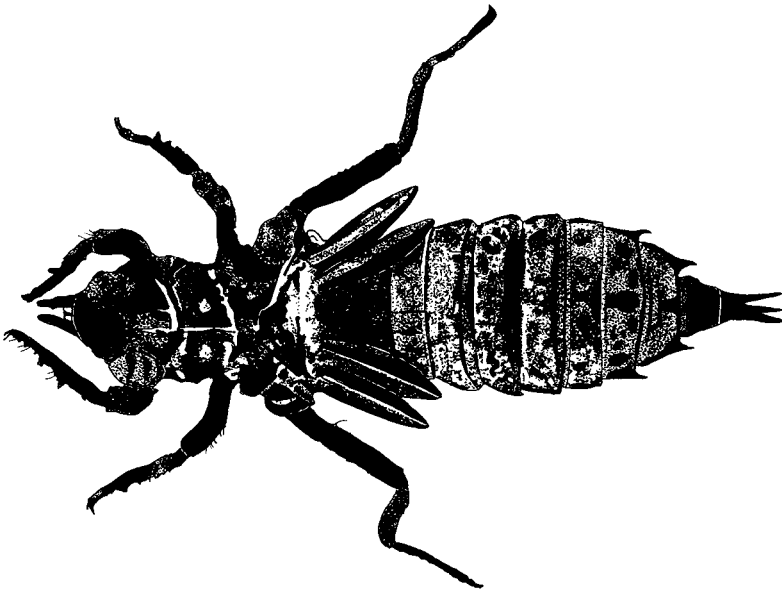


Fig. 3.2.597 *Zonophora batesi* larva: habitus from an exuvia. Based on Belle (1966c).

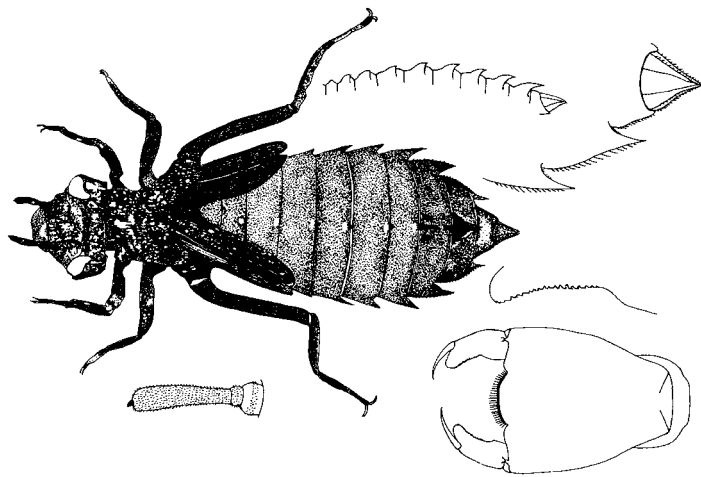


Fig. 3.2.598 *Erpetogomphus sabaleticus* larva: habitus from the exuvia of a female, with the head somewhat distorted (left), the antenna of a male (lower left center), labium of a male in ventral view below the outline of the inner surface of a labial palp (lower right), outline of the dorsal part of the abdomen of a male in lateral view (upper right center), and the left side of the apex of a male abdomen in dorsal view (upper right). Based on Belle (1992a).

- 4. The wing cases diverge toward the apices (**Fig. 3.2.594**).5
 - The wing cases are oriented parallel (**Fig. 3.2.597**).6
- 5. The coxae of the middle legs are nearly in contact with each other. The mentum of the labium is narrow (**Fig. 3.2.594**).
.....*Progomphus* Selys, 1854..pp. 551
 - The coxae of the middle legs are well separated. The mentum of the labium is broad (**Fig. 3.2.598**).
.....*Erpetogomphus* Selys, 1857
- In addition to about 15 North and Central American species, there is one species known from South America, *Erpetogomphus sabaleticus* Williamson, 1918, known from Panama, Colombia, and Venezuela. It has been recommended for consideration as an endangered species in Venezuela (DeMarmels, 1999).
- 6. There are no dorsal hooks on the abdomen (**Fig. 3.2.597**).7
 - Dorsal hooks are present on the abdomen (**Fig. 3.2.599**).10
- 7. Large lateral spines that curve dorsad are present only on the eighth and ninth segments of the abdomen. The larva appears hairy. The median lobe of the labium is squarely truncate anteriorly (**Fig. 3.2.597**).
.....*Zonophora* Selys, 1854..pp. 542
 - Lateral angulations or short, triangular spines are present on the seventh through ninth abdominal segments (**Fig. 3.2.600**).8

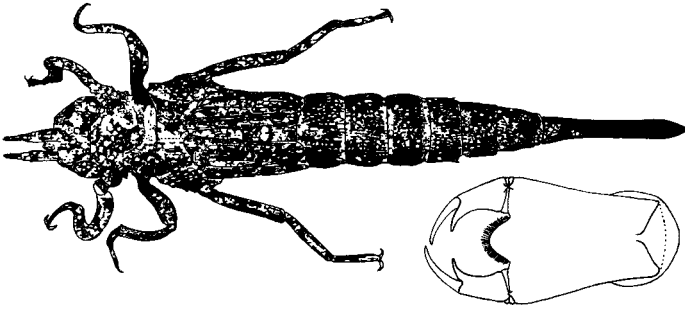


Fig. 3.2.599 *Phyllocycla viridipleuris* larva: habitus from an exuvia (above) and labium in ventral view (lower right). Based on Belle (1992a).

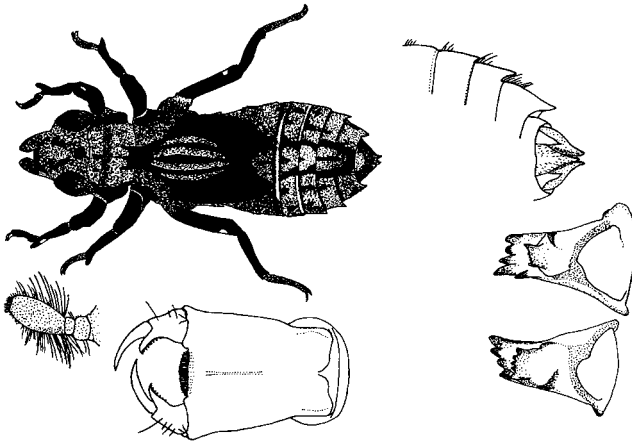


Fig. 3.2.600 *Praeiviogomphus proprius* larva: habitus of a female larva (upper left), antenna (lower left), labium in ventral view (lower center), inner surface of the mandibles (lower right), and the right margin of the apical segments of the abdomen in dorsal view (upper right). Based on Carvalho (2000).

8. The anterior margin of the prementum is slightly concave, armed with three dark triangular denticles, and fringed with setae, which are about three times the length of the denticles. There are strong burrowing hooks on the fore and middle tibiae (**Fig. 3.2.600**). The only known species reaches a maximum length of about 20.1 to 23.7 mm.

.....*Praeiviogomphus* Belle, 1995

The only species described in this genus is *Praeiviogomphus proprius* Belle, 1995, known only from the state of Rio de Janeiro, Brazil.

- The median lobe of the labium is concave anteriorly (**Fig. 3.2.601**).9

9. The medium lobe of the labium is about as long as it is wide at its anterior end; the front margin of its median lobe bears 7 to 11 black denticles (**Fig. 3.2.601**).

.....*Epigomphus* Hagen in Selys, 1854..pp. 657
 - The prementum of the labium is about a third to a half longer than it is wide at the anterior end; the front margin of its median lobe bears three black denticles (**Fig. 3.2.602**).

.....*Neogomphus* Selys, 1858..pp. 538

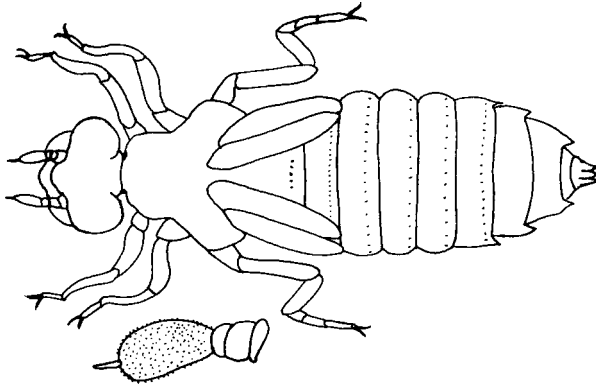


Fig. 3.2.601 *Epigomphus paludosus* female larva: habitus from an exuvia (above) and an antenna (below). Based on Costa (1968).

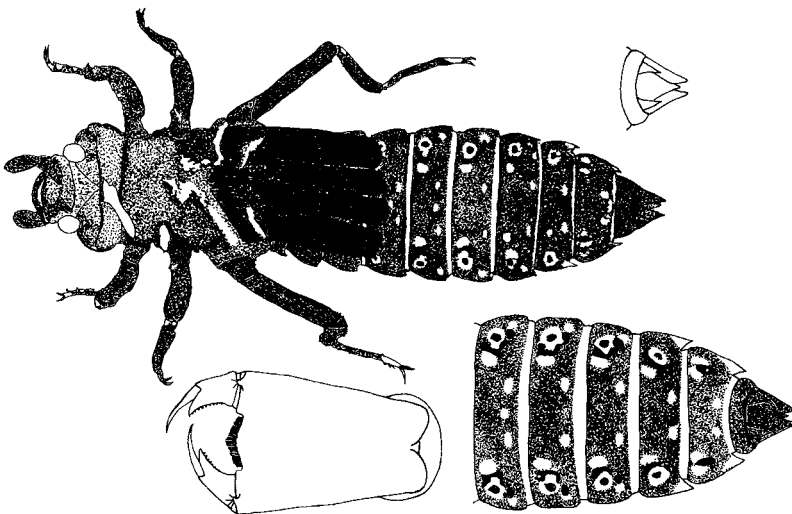


Fig. 3.2.602 *Neogomphus edenticulatus* larva: habitus (upper left), pattern on the apical segments of the abdomen (lower right), labium (lower left center), and apex of the abdomen in dorsal view (upper right). Based on Belle (1992a).

10. There are hooks for burrowing on the fore and middle tibiae (**Fig. 3.2.599**).11
- The fore and middle tibiae lack burrowing hooks (**Fig. 3.2.603**). 16

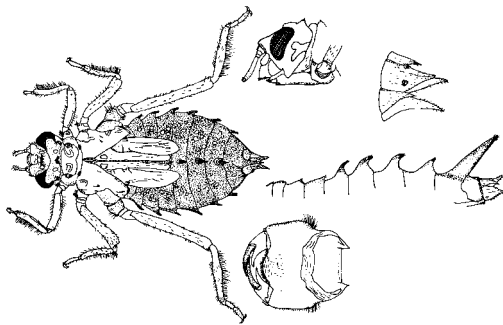


Fig. 3.2.603 *Tibiogomphus noval* larva: habitus (left), head in lateral (upper center) and ventral view (lower center), dorsal profile of abdomen showing spines (middle right), and caudal appendages in dorsolateral view (upper right). Based on Rodrigues Capitulo (1984).

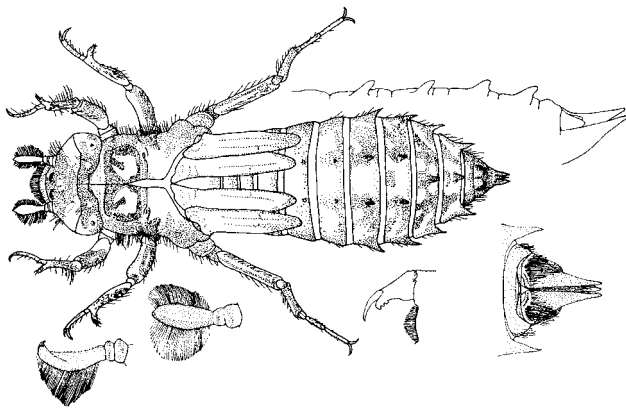


Fig. 3.2.604 *Desmogomphus tigrivensis* larva: habitus (upper left), antenna in lateral and dorsal view (lower left), anterior margin of prementum and labial palp (lower center), profile of the dorsal margin of the abdomen (upper right), and apex of the abdomen in ventral view (lower right). Based on Belle (1977a).

11. The tenth abdominal segment forms an elongated tube about a quarter of the length of the abdomen (**Fig. 3.2.599**).12
- The tenth abdominal segment is shorter than the combined length of the eighth and ninth segments (**Fig. 3.2.604**).13

12. Lateral spines are lacking. The median lobe of the labium is only slightly convex. There are several long, saber-like teeth on the inner margin of the lateral lobe of the labium before the hook (**Fig. 3.2.605**).

.....*Aphylla* Selys, 1854..pp. 590

- Lateral spines are present, although sometimes minute. The median lobe of the labium is deeply convex with a nearly semicircular profile. There are usually no teeth on the inner margin of the lateral lobe of the labium, but if they are present, they are not long (**Fig. 3.2.599**).

.....*Phyllocycla* Calvert, 1948..p. 602

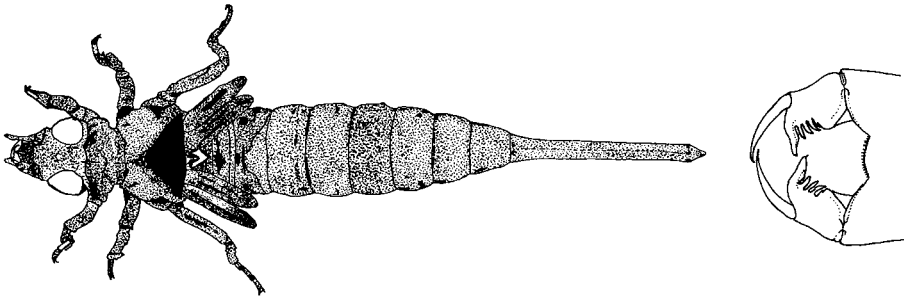


Fig. 3.2.605 *Aphylla* sp. larva: habitus (left) and the anterior part of the labium (right). Based on Belle's (1964b) unconfirmed identification of "*Aphylla simulata*," now considered a synonym of *Aphylla dentata*.

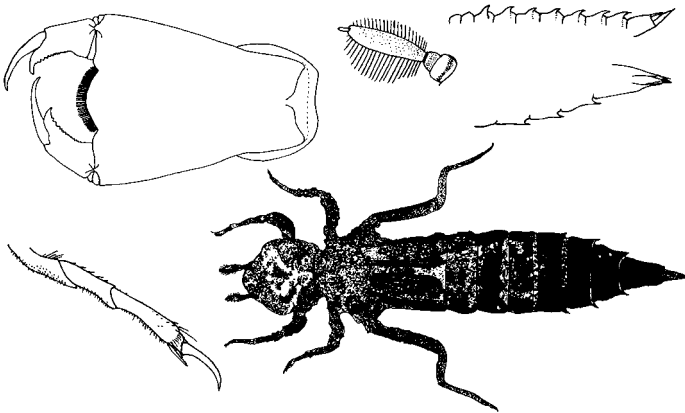


Fig. 3.2.606 *Gomphoides infumatus* larva: labium in ventral view (upper left), antenna (upper center), hind tarsus (lower left), profile of the upper surface of the abdomen (upper right), outline of the left side of the abdomen in dorsal view (middle right), and habitus from an exuvia (lower right). Based on Belle (1992a).

13. The tenth abdominal segment is about half as long as the ninth (**Fig. 3.2.604**).

.....*Desmogomphus* Williamson, 1920..p. 588
 - The tenth abdominal segment is equal in length to the ninth or longer (**Fig. 3.2.606**). 14

14. There are lateral spines on the fifth through ninth abdominal segments.

.....*Idiogomphoides* Belle, 1984..p. 621
 - There are lateral spines only on the seventh through ninth abdominal segments (**Fig. 3.2.606**). 15

15. The ligula occupies the middle 3/5 of the front margin of the prementum, and it has a pair of brown submedian denticles at its apex (**Fig. 3.2.606**).

.....*Gomphoides* Selys, 1854..p. 620
 - The ligula occupies only the middle 2/5 of the front margin of the prementum, and there are no brown denticles at its apex (**Fig. 3.2.607**).

.....*Phyllogomphoides* Belle, 1970..p. 622

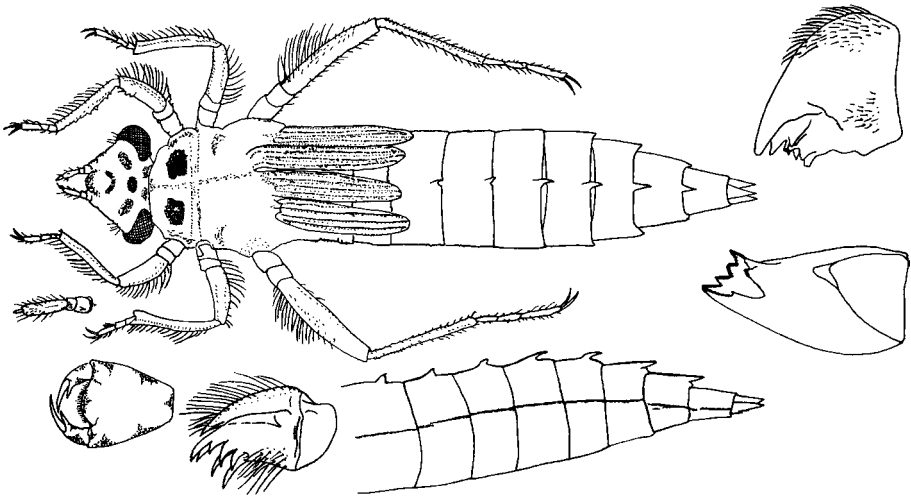


Fig. 3.2.607 *Phyllogomphoides annectens* larva: habitus (above); antenna (middle left); labium (lower left), maxilla (lower left center), lateral profile of the abdomen (lower right), and the left and right mandibles greatly enlarged (right). Based on Costa *et al.* (2000).

16. The width of the abdomen is no more than 1/3 of its length. The tenth abdominal segment is much longer than the ninth. There is a row of teeth along the inner margin of each labial palp (**Fig. 3.4**).

.....*Peruviogomphus* Klots, 1944..p. 617

- The width of the abdomen is usually more than 1/3 of its length. The tenth abdominal segment is shorter than the ninth. The inner margin of each labial palp is toothless (**Fig. 3.2.603**).17
 17. On the ninth abdominal segment, the dorsal hook is especially long and robust, and it points straight in an oblique, generally posteriad direction (**Fig. 3.2.603**).

.....*Tibiagomphus* Belle, 1992..p. 649
 - The dorsal hook on the ninth abdominal segment is curved and is not notably larger than all of the others (**Fig. 3.2.608**). 18

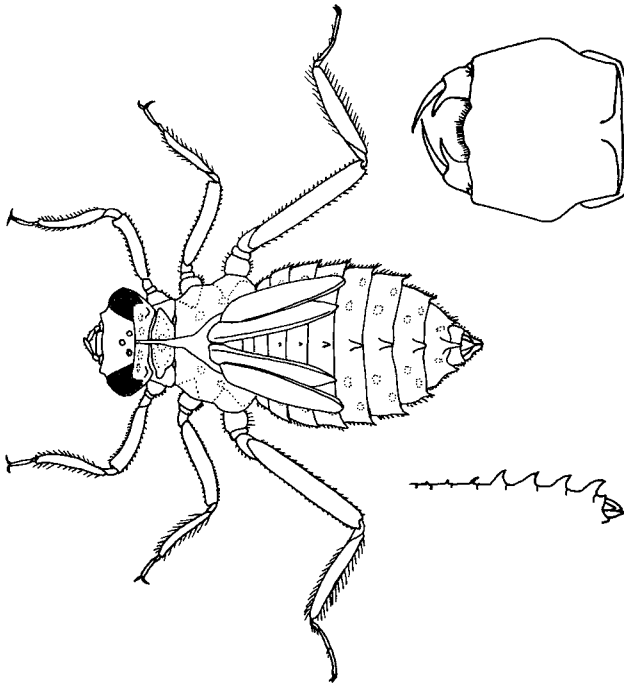


Fig. 3.2.608 *Agriogomphus sylvicola* larva: habitus from an exuvia (left), labium (upper right), and profile of the dorsal surface of the abdomen (lower right). Based on Belle (1966b).

18. The dorsal hooks on the sixth through ninth abdominal segments are not slender, erect, or nearly equal in length; the ninth is the largest and directed generally posteriad (**Fig. 3.2.608**).

.....*Agriogomphus* Selys, 1869..p. 650
 - The dorsal hooks on the sixth through ninth abdominal segments are slender and erect, and those on the sixth and ninth are nearly equally long (**Fig. 3.2.609**).
*Cyanogomphus* Selys, 1873..p. 642

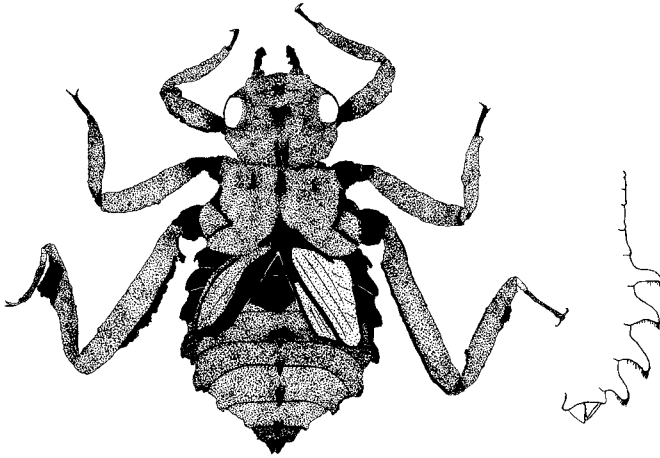


Fig. 3.2.609 Habitus of a *Cyanogomphus minutus* larva (left) and profile of the dorsal surface of the abdomen (right). Based on Belle (1970a).

Key to the adults of the genus *Neogomphus* in South America

Information for the key was provided by Schmidt (1941a), St. Quentin (1967), and Carle and Cook (1984).

1. The inferior anal appendage is about half as long as the superior appendage, and both appendages are armed with two lateral spines at the base. The apices of the anterior hamuli are recurved with a notch extending $\frac{1}{3}$ of the length. The vulvar lamina of the female is longer than the ninth abdominal segment along its ventral midline. The ocellar ridge ends posterior to the middle of each lateral ocellus. The pterostigma in the fore-wing of the male is about 2 mm, and that in the hind wing is about 2.5 mm, while that in the fore-wing of the female is 2.3 to 2.5 mm, and that in the hind wing, 2.8 to 3 mm (**Fig. 3.2.574**). Abdomen length of male: 33 to 36 mm; of female: 31 to 35 mm. Hind wing length of male: 26 to 28 mm; of female: 28 to 29.5 mm. Color of male: blackish brown markings on a greenish ground color.

..... *Neogomphus bidens* Selys, 1878 (Chile).

- The superior and inferior anal appendages are about equal in length, and both appendages are armed with one lateral spine at the base (**Fig. 3.2.610**). The apices of the anterior hamuli are not recurved, and the notch extends less than $\frac{1}{4}$ of the length. The vulvar lamina of the female is shorter than the ninth abdominal segment along its ventral midline. The ocellar ridge ends posterior to the outer edge of each lateral ocellus. 2

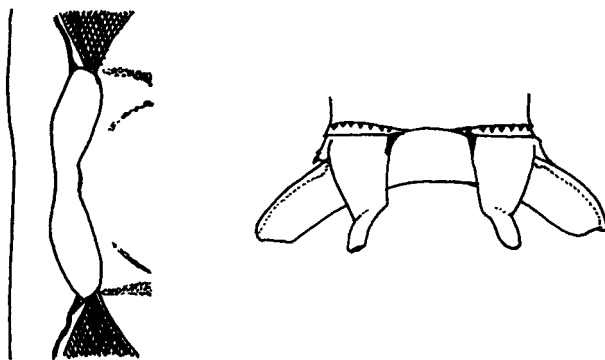


Fig. 3.2.610 *Neogomphus edenticulatus*: posterodorsal view of the head of a female (left) and the appendages at the apex of a male abdomen in dorsal view. Based on Carle and Cook (1984).

2. The face is mainly brown, and the synthorax has brown bands bordering the metapleural sulci. There are no dorsolateral denticles on the antefrons of the male. The bases of the superior anal appendages of the male are separated by a distance approximately equal to $1/2$ the length of an appendage. The median part of the postocellar ridge of the female is highest. The postfrontal suture of the female is about 2.0 mm long. The pterostigma in the fore-wing of the male is 2.1 to 2.5 mm long, and that in the hind wing is about 2.5 to 3.0 mm, while that in the fore-wing of the female is 2.5 to 3.0 mm, and that in the hind wing, 3.0 to 3.3 mm (**Fig. 3.2.610**). Abdomen length of male including appendages: 33 to 35 mm; of female: 31 to 35 mm. Hind wing length of male: 23.5 to 28 mm; of female: 26 to 30 mm. Color of male: brown, yellow, and green.

.....*Neogomphus edenticulatus* Carle and Cook, 1984 (Argentina, Chile).

- The face is mainly yellow, and there are no brown bands bordering the metapleural sulci. There are dorsolateral denticles on the antefrons of the male. The bases of the superior anal appendages of the male are separated by a distance approximately equal to $1/3$ the length of an appendage. The lateral parts of the postocellar ridge of the female are highest. The postfrontal suture of the female is about 1.5 mm long. The pterostigma in the fore-wing of the male is 1.6 to 1.8 mm, and that in the hind wing is about 2 to 2.3 mm, while that in the fore-wing of the female is 2 to 2.2 mm, and that in the hind wing, 2.5 to 2.7 mm (**Fig. 3.2.611**). Abdomen length of male: 29 to 31 mm; of female: 30.5 to 32 mm. Hind wing length of male: 23.5 to 25.5 mm; of female: 25.5 to 26.5 mm. Color of male: brown markings on a yellow ground color.

.....*Neogomphus molestus* (Hagen in Selys, 1954) (Chile, Brazil?). Syn: *Hemigomphus molestus* Hagen in Selys, 1954; *Hemigomphus elegans* Selys, 1954.

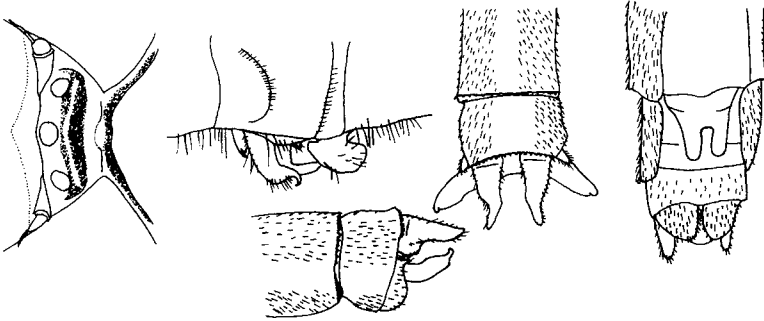


Fig. 3.2.611 *Neogomphus molestus* (above, left to right): dorsal view of the ocellar region of the head, male genitalia on the second abdominal segment in lateral view, apex of the abdomen of a male in dorsal view, that of a female in ventral view, and a lateral view of the apex of a male abdomen (below). Based on Schmidt (1941a).

Key to the *Neogomphus* larvae in South America

Information for the key was provided by Belle (1992a).

1. On the posterolateral corners of the sixth or seventh through the ninth abdominal segments, there are short, triangular spines (**Fig. 3.2.612**). The total length reaches 28 mm.

.....*Neogomphus bidens* Selys, 1878 (Chile).

- Short triangular spines are present at the posterolateral corners of only the eighth and ninth abdominal segments (**Fig. 3.2.602**).2

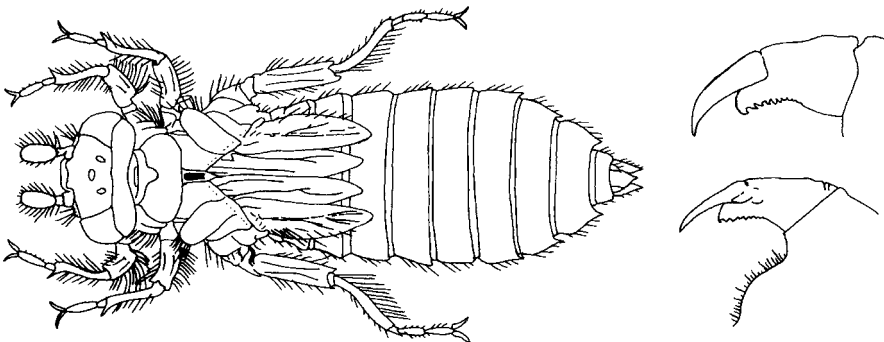


Fig. 3.2.612 Habitus of a *Neogomphus bidens* larva (left), median margin of the prementum and labial palp of a *Neogomphus molestus* larva (lower right), and the labial lobe of a *Neogomphus bidens* larva (upper right). Based on Needham and Bullock (1943).

2. The abdomen has a distinct color pattern (**Fig. 3.2.602**).

.....*Neogomphus edenticulatus* Carle and Cook, 1984
(Argentina, Chile).

- The abdomen is grayish brown without any definite pattern (**Fig. 3.2.612**).

.....*Neogomphus molestus* (Hagen in Selys, 1954)
(Chile, Argentina, Brazil). Syn: *Hemigomphus molestus* Hagen in Selys, 1954;
Hemigomphus elegans Selys, 1954.

Key to the adults of the genus *Melanocacus* in South America

Information for the key was provided by Needham (1940) and Belle (1986a). It is not yet possible to prepare a key to the larvae.

1. The eighth abdominal segment has conspicuous, foliate, lateral extensions. There in are 18 to 22 denticles in the inner row on the superior anal appendage of the male (**Fig. 3.2.613**). Total length: 60 mm; length of abdomen: 42 mm; Hind wing length: 34 mm.

.....*Melanocacus mungo* (Needham, 1940)
(French Guiana, Surinam). Syn: *Cacus mungo* Needham, 1940.

- The lateral extensions on the eighth abdominal segment are narrow and inconspicuous. There in are 25 or 26 denticles in the inner row on the superior anal appendage of the male (**Fig. 3.2.572**). Total length: 62 to 64 mm. Length of abdomen: 47 to 48 mm. Hind wing length: 36 to 39 mm.

.....*Melanocacus interioris* Belle, 1986
(Mato Grosso).

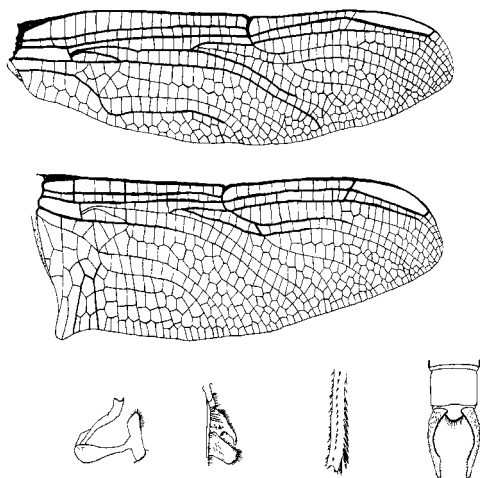


Fig. 3.2.613 *Melanocacus mungo*: fore and hind wings (above) and (below, left to right): penis, hamules, tibial comb, and the apex of the male abdomen in dorsal view. Based on Needham (1940).

Key to the adult males of the genus *Zonophora* in South America

Information for the key was provided by Schmidt (1941b) and Belle (1966c, 1976a, 1983b).

1. A basal subcostal cross vein and two or three cubital cross veins are present. One of the sixth to eighth anal cross veins, usually the seventh but often the sixth in the hind wing of males, is the second thickened cross vein in the series. The penis has a short end filament (**Fig. 3.2.577**).

.....*Zonophora calippus* Selys, 1869 (Guyana, French Guiana, Surinam, Venezuela, Peru, Paraguay, Pará, Amazonas, São Paulo). One of the three subspecies, *Zonophora calippus calippus*, inhabits Venezuela, Guyana, French Guiana, Surinam, and Pará. *Zonophora calippus klugi* Schmidt, 1941, is known from Peru, Ecuador, Amazonas, Rondônia, and Acre; *Zonophora calippus spectabilis* (H. Campion, 1920), inhabits Paraguay, Bolivia, Argentina, and São Paulo. *Z. calippus calippus* is characterized by a lack or paucity of yellow markings on the eighth through tenth abdominal segment and the weakness or absence of an interrupted median black stripe in the pale anterior band on the frons; this black band is narrower than 1/3 of the mid-dorsal length of the frons. Its abdomen is 42 to 46 mm long, and its hind wing measures 34 to 36.5 mm in length. *Z. calippus klugi* also has no more than vestigial yellow markings on the eighth through tenth abdominal segments, but it has a well-developed interrupted black band in the pale anterior band across the frons; the black band is at least 1/3 as wide as the mid-dorsal length of the frons. Its abdomen measures 44.5 to 48 mm, and its hind wing is 38 to 41 mm long. *Z. calippus spectabilis* is recognized by the extensive yellow pattern on the eighth through tenth abdominal segments. Its abdomen is c. 41 mm, and its hind wing is c. 34.5 mm long.

- The basal subcostal cross vein is absent (**Fig. 3.2.614**).2

2. The anterior hamule has an internal lobe (**Fig. 3.2.615**). Along the internal margin of the superior anal appendage, a “knotty” area is present at about the midlength.3

- The anterior hamule has an internal lobe (**Fig. 3.2.614**). Along the internal margin of the superior anal appendage, a “knotty” area is present at about the midlength.5

3. The second pale antehumeral stripe is not well developed, or the lateral surface of the synthorax is almost entirely pale (**Fig. 3.2.615**). Length of abdomen of *Z. s. solitaria*: c. 54 mm. Hind wing length: 43 to 44 mm.

.....*Zonophora solitaria* Rácenis, 1970 (Venezuela). Two subspecies have been described: *Zonophora solitaria solitaria* Rácenis, 1970, predominantly pale on the lateral surfaces of the synthorax; *Zonophora solitaria obscura* Belle, 1976, with distinct dark lateral stripes on the synthorax and an abdomen about 48.5 mm long.

- The dark stripes on the lateral surface of the synthorax and the second pale antehumeral stripes are well developed (**Fig. 3.2.616**).4

4. The apical segment of the penis bears a pair of very short spines (**Fig. 3.2.616**).

.....*Zonophora surinamensis* Needham, 1944
(Venezuela, Surinam, Amapá).

- The apical segment of the penis bears a pair of recurved foliate plates (**Fig. 3.2.617**). Total length: c. 81 mm. Length of abdomen: c. 62 mm. Hind wing length: c. 51.5 mm. Length of pterostigma in fore-wing: c. 6 mm.

.....*Zonophora regalis* Belle, 1976
(Venezuela).

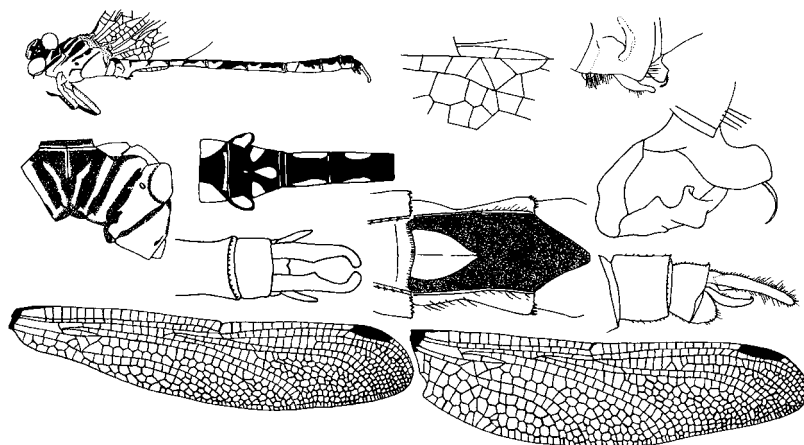


Fig. 3.2.614 *Zonophora supratrangularis*: habitus with wing bases in lateral view (upper left), fore (lower left) and hind wing (lower right), area of the arculus and triangles in the hind wing (upper center), male genitalia on the second abdominal segment in lateral view (upper right), penis in lateral view (upper middle right), diagram of the color pattern on the thorax (middle left), color pattern on the first three abdominal segments (below habitus), apex of the abdomen of a male in dorsal (center, above fore-wing) and lateral view (lower middle right), and the ninth abdominal sternite of a female in ventral view (right of center). Based on Schmidt (1941b).

5. The apical segment of the penis bears short spines resembling tusks. The interior lobe of the anterior hamule is digitiform and distinct (**Fig. 3.2.618**).6

- The apical segment of the penis bears long flagellae. The interior lobe of the anterior hamule is minute (**Fig. 3.2.614**).7

6. The posterior hamules diverge from about midlength. The anterior hamules are not obviously trilobate because the superior lobe is poorly developed (**Fig. 3.2.618**).

.....*Zonophora diversa* Belle, 1983
(Argentina, Paraguay, Santa Catarina).

- The apical halves of the posterior hamules run parallel. The anterior hamules have three well-developed lobes. The metepimeron is entirely yellow. There is no T-shaped black mark on the forehead. Usually, no more than 20 anal cross veins are present in the fore-wing of the male, and there are 19 to 24 in the female; the second thickened one is one of the sixth through ninth, usually the seventh. The pterostigma is brown (**Fig. 3.2.619**). Length of abdomen: 49 to 53 mm. Hind wing length: 42 to 50 mm.

.....*Zonophora campanulata* (Burmeister, 1839)
(Surinam? Guyana? Goiás, Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo, Santa Catarina, Paraná). Syn: *Diastatomma campanulata* (Burmeister, 1839). Three subspecies are recognized: *Zonophora campanulata annulata* Belle, 1983, *Zonophora campanulata campanulata* (Burmeister, 1839), and *Zonophora campanulata machadoi* St. Quentin, 1973, all known from central to southeastern Brazil. *Z. campanulata campanulata* is recognized by the scarcity or absence of yellow markings on the abdomen. *Z. campanulata annulata* has an isolated pale first antehumeral stripe, which is connected neither to the pale collar nor to the second antehumeral stripe. In *Z. campanulata machadoi*, the first antehumeral stripe is contiguous both with the pale collar and the second antehumeral stripe.

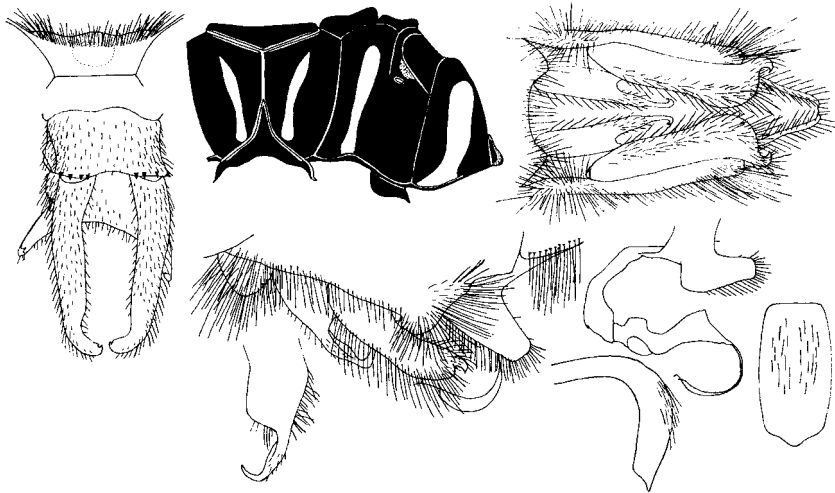


Fig. 3.2.615 *Zonophora solitaria obscura* male: occipital plate (upper left), diagrammatic depiction of the black and yellow color pattern on the synthorax (upper center), tenth abdominal segment with appendages in dorsal view (lower left), the genitalia on the second abdominal segment in ventral (upper right) and lateral view (middle, below pterothorax), and enlargements of the right hamule (lower left center), penis guard in anterior (lower right) and lateral view (lower right center), and the penis in lateral view (middle right). Based on the figure labeled *Zonophora obscura* by Belle (1976a).

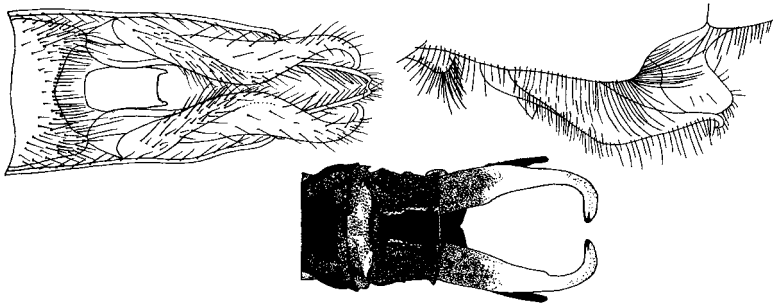


Fig. 3.2.616 *Zonophora surinamensis* male: apex of the abdomen in dorsal (below) and ventral view (above, left) and the genitalia on the ventral side of the second abdominal segment (above right). Based on Belle (1966c).

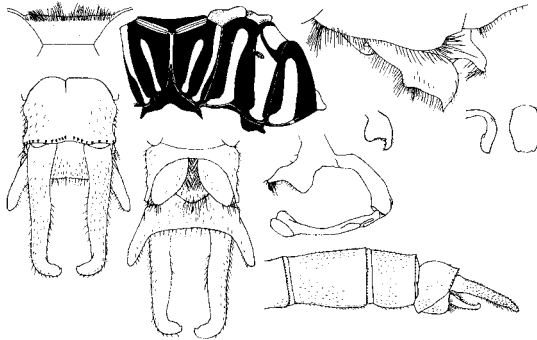


Fig. 3.2.617 *Zonophora regalis* male: occipital plate (upper left), diagrammatic depiction of the color pattern on the pterothorax (upper center), tenth abdominal segment with appendages in dorsal (lower left) and ventral view (lower center), genitalia on the second abdominal segment in lateral view (upper right), enlargements of the right hamule (below genitalia and right of thorax) and penis guard in lateral and anterior view (middle right, left and right), penis in lateral view (lower middle right), and the apical segments of the abdomen (lower right). Based on Belle (1976a).

7. The supratrangles are crossed (**Fig. 3.2.614**).8
 - The supratrangles are free (**Fig. 3.2.620**).9
 8. The mid-dorsal length of the tenth abdominal segment is only slightly more than 1/3 the length of the superior anal appendage, which has an internal tooth about 60% of the way from the base to the apex (**Fig. 3.2.621**).
*Zonophora nobilis* Belle, 1983
 (Venezuela, Amazonas).

- The mid-dorsal length of the tenth abdominal segment is about half the length of the superior anal appendage, which has an internal tooth about 50% of the way from the base to the apex. Two or three cubital cross veins are present. Labrum dark but usually has two yellow flecks that are not contiguous. There is a T-shaped black spot on the frons. The abdomen has extensive yellow markings. The anterior hamules are laterally compressed (**Fig. 3.2.614**). Length of abdomen: 41 to 43.5 mm. Length of hind wing: 34 to 38 mm.

.....*Zonophora supratrangularis* Schmidt, 1941
(Venezuela, Amazonas).

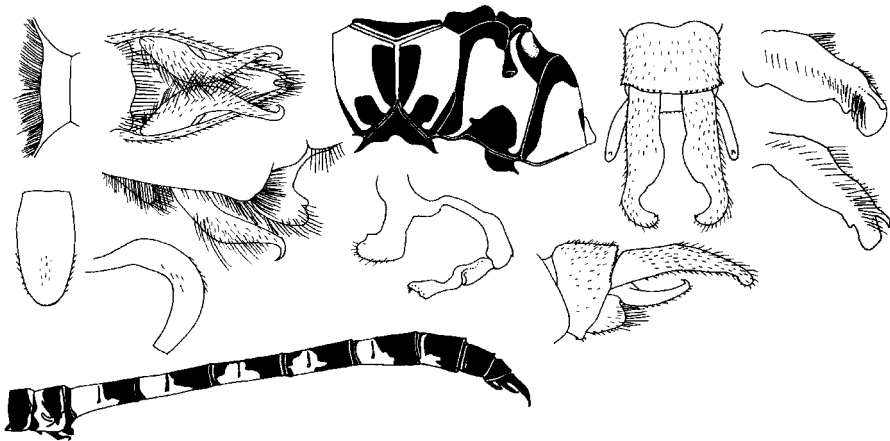


Fig. 3.2.618 *Zonophora diversa* male: occipital plate (upper left), genitalia on the second abdominal segment in ventral and lateral view (upper left center, above and below, respectively), diagram of the color pattern on the synthorax (upper center), penis guard in anterior and lateral view (middle left, left and right, respectively), penis in lateral view (center), color pattern on the male abdomen in lateral view (lower left), apex of the male abdomen in dorsal (upper right center) and lateral view (lower right center), anterior hamule in right lateral and oblique interior view (upper and middle right, respectively). Based on Belle (1983b).

9. The seventh abdominal segment has a large pale marking at its base (**Fig. 3.2.620**). Length of abdomen: 53 to 55 mm. Hind wing length: 44 to 46 mm.

.....*Zonophora batesi* Selys, 1869
(Venezuela, Guyana, French Guiana, Surinam, Amazonas).

- The seventh abdominal segment is uniformly black (**Fig. 3.2.622**). Length of abdomen: 52 to 54 mm. Hind wing length: 44 to 47 mm.

.....*Zonophora wucherpennig* Schmidt, 1941
(Amazonas).

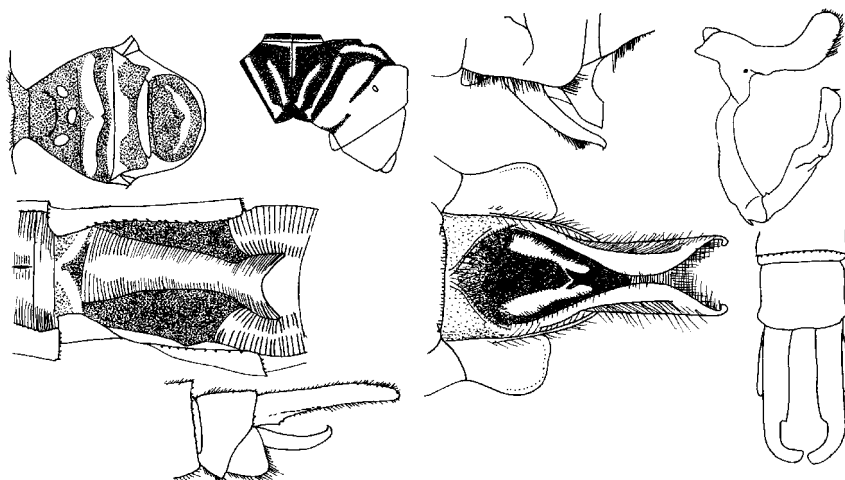


Fig. 3.2.619 *Zonophora campanulata* (above, left to right): color pattern on the head between the compound eyes; diagram of the color pattern on the thorax; male genitalia on the second abdominal segment in lateral view; penis in lateral view; and (below, left to right): ninth abdominal sternite of a female in ventral view; apex of a male abdomen in lateral view (below ninth sternite); second abdominal segment of a male in ventral view showing the anterior lamina, hamuli, and auricles; superior anal appendages at the apex of a male abdomen in dorsal view. Based on Schmidt (1941b).

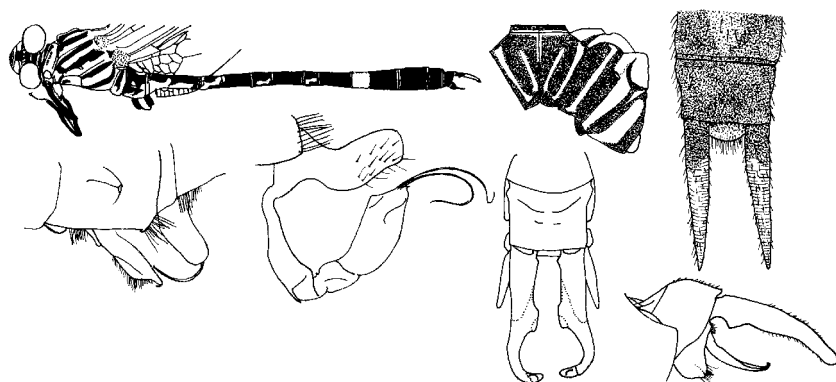


Fig. 3.2.620 *Zonophora batesi* (above, left to right): habitus in lateral view with bases of the wings; diagram of the color pattern on the thorax; superior anal appendages at the apex of a female abdomen in dorsal view, and (below, left to right): male genitalia on the second abdominal segment in lateral view; penis in lateral view; male abdomen in dorsal and lateral view. Based on Schmidt (1941b).

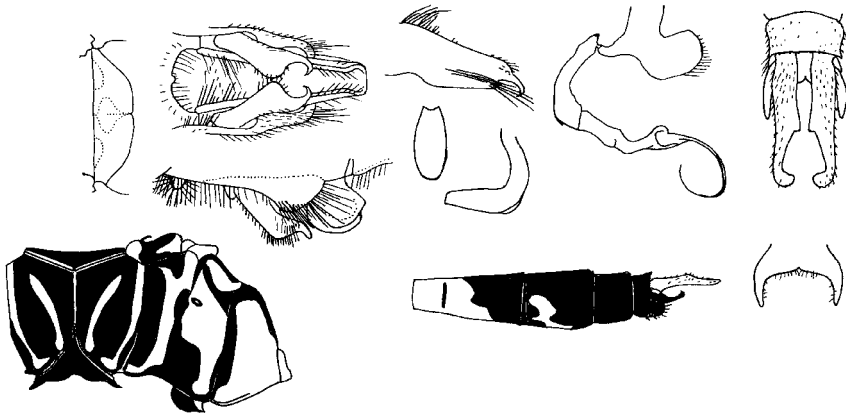


Fig. 3.2.621 *Zonophora nobilis*: male genitalia on the second abdominal segment in ventral and lateral view (upper left center, above and below, respectively), diagram of the color pattern on the synthorax (lower left), hamule in right lateral view (upper center), penis guard in anterior and lateral view (center, left and right, respectively), penis in lateral view (upper right center), color pattern on the apical segments of the male abdomen (lower center), apex of the male abdomen in dorsal view (upper right), apex of the inferior anal appendage in ventral view (lower right), and vulvar lamina in the ninth segment of the female abdomen in ventral view (upper left). Based on Belle (1983b) and DeMarmels (1989a).

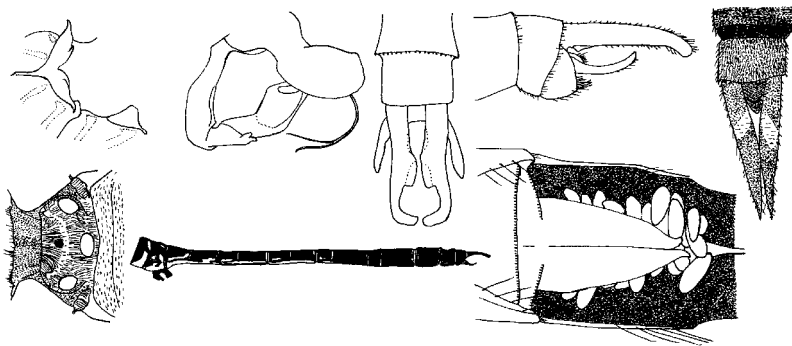


Fig. 3.2.622 *Zonophora wucherpennigi* (above, left to right): wing roots of the fore and hind wings in dorsal view, penis in lateral view, apex of the male abdomen in dorsal and lateral view, apex of a female abdomen in dorsal view, and (below, left to right): color pattern between the compound eyes on the head of a female, color pattern on the abdomen of a male in lateral view, and the ninth abdominal sternite of a female in ventral view, showing emerging eggs. Based on Schmidt (1941b).

Key to the adult females of the genus *Zonophora* in South America

Information for the key was provided by Schmidt (1941b) and Belle (1983b). The females of *Zonophora diversa*, *Z. surinamensis*, and *Z. regalis* cannot yet be included in a key.

1. A basal subcostal cross vein is usually present (**Fig. 3.2.577**).

.....*Zonophora calippus* Selys, 1869 (Guyana, French Guiana, Surinam, Venezuela, Peru, Paraguay, Pará, Amazonas, São Paulo). One of the three subspecies, *Zonophora calippus calippus*, inhabits Venezuela, Guyana, French Guiana, Surinam, and Pará. *Zonophora calippus klugi* Schmidt, 1941, is known from Peru, Ecuador, Amazonas, Rondônia, and Acre; *Zonophora calippus spectabilis* (H. Campion, 1920), inhabits Paraguay, Bolivia, Argentina, and São Paulo. *Z. calippus calippus* is characterized by a lack or paucity of yellow markings on the eighth through tenth abdominal segment and the weakness or absence of an interrupted median black stripe in the pale anterior band on the frons; this black band is narrower than 1/3 of the mid-dorsal length of the frons. Its abdomen is 43 to 48 mm long, and its hind wing measures 38 to 40 mm in length. *Z. calippus klugi* also has no more than vestigial yellow markings on the eighth through tenth abdominal segments, but it has a well-developed interrupted black band in the pale anterior band across the frons; the black band is at least 1/3 as wide as the mid-dorsal length of the frons. Its abdomen measures 43.5 to 49 mm, and its hind wing is 40.5 to 45 mm long. *Z. calippus spectabilis* was described based only on a male specimen.

- The basal subcostal cross vein is always absent (**Fig. 3.2.614**).2

2. The vulvar lamina is a short plate across the basal part of the ninth abdominal segment with a slight median cleft (**Fig. 3.2.621**).

.....*Zonophora nobilis* Belle, 1983 (Venezuela, Amazonas).

- The vulvar lamina extends posteriad to cover at least 1/3 of the ninth abdominal sternite (**Fig. 3.2.614**).3

3. The vulvar lamina is no more than half as long as the ninth abdominal sternite (**Fig. 3.2.614**).4

- The vulvar lamina reaches the apex of the ninth abdominal sternite (**Fig. 3.2.619**).5

4. The vulvar lamina is half as long as the ninth abdominal sternite. The second pale antehumeral stripe is distinct (**Fig. 3.2.614**).

.....*Zonophora supratrangularis* Schmidt, 1941 (Venezuela, Amazonas).

- The vulvar lamina is about 1/3 as long as the ninth abdominal sternite. The second antehumeral stripe is absent or indistinct, as in the male (**Fig. 3.2.615**).

..... *Zonophora solitaria obscura* Belle, 1976 (Venezuela). Nobody has described the female *Zonophora solitaria solitaria*.

5. The vulvar lamina is much longer than wide with sides that are roughly parallel or narrowing slightly toward the apex (**Fig. 3.2.619**). Length of abdomen: 50 to 52 mm. Hind wing length: 49 to 50 mm.

.....*Zonophora campanulata* (Burmeister, 1839)
(Surinam? Guyana? Goiás, Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo, Santa Catarina, Paraná). Syn: *Diastatomma campanulata* (Burmeister, 1839). Three subspecies are recognized: *Zonophora campanulata annulata* Belle, 1983, *Zonophora campanulata campanulata* (Burmeister, 1839), and *Zonophora campanulata machadoi* St. Quentin, 1973. Syn: *Diastatomma campanulata* (Burmeister, 1839), all known from central to southeastern Brazil. *Z. campanulata campanulata* is recognized by the paucity or absence of yellow markings on the abdomen. The first pale antehumeral stripe of *Z. campanulata annulata* is isolated, not being connected either to the pale collar or to the second antehumeral stripe. In *Z. campanulata machadoi*, the first antehumeral stripe is contiguous with both the pale collar and the second antehumeral stripe.

- The shape of the vulvar lamina is approximately triangular with a width at its base about half of its length (**Fig. 3.2.620**).6

6. The lobes of the vulvar lamina are well separated at the base of the excision. The anal appendages are black at the base and white apically (**Fig. 3.2.620**). Length of abdomen: 55 to 58 mm. Hind wing length: 49 to 52 mm.

.....*Zonophora batesi* Selys, 1869
(Venezuela, Guyana, French Guiana, Surinam, Amazonas).

- The lobes of the vulvar lamina are close at the base of the excision. The anal appendages are black at the base, then brown, becoming darker toward the apex (**Fig. 3.2.622**). Abdomen length: c. 56 mm. Hind wing length: c. 50 mm.

.....*Zonophora wucherpennigi* Schmidt, 1941
(Amazonas).

Key to the species of *Zonophora* larvae in South America

Information for the key was provided by Belle (1966c). This key is only preliminary since the larvae of only two species could be included.

1. The widest part of the abdomen is at the sixth and seventh segments, with the seventh segment wider than the fifth. The length of the abdomen is equal to or greater than three times its maximum width (**Fig. 3.2.623**).

.....*Zonophora calippus* Selys, 1869
(Guyana, French Guiana, Surinam, Venezuela, Peru, Paraguay, Pará, Amazonas, São Paulo). Descriptions of the larvae of each subspecies are not yet available.

- The widest part of the abdomen is at the fifth and sixth segments, so the fifth is usually slightly wider than the seventh. The length of the abdomen is only slightly more than twice its maximum width (**Fig. 3.2.597**).

.....*Zonophora batesi* Selys, 1869
(Venezuela, Guyana, French Guiana, Surinam, Amazonas).

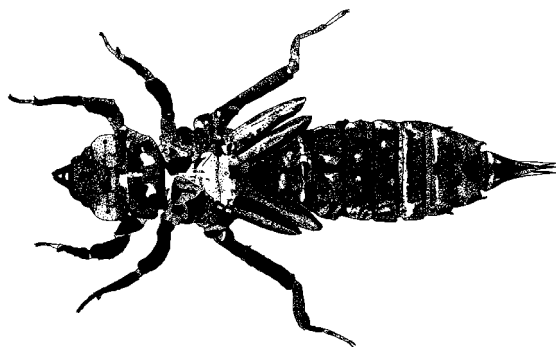


Fig. 3.2.623 *Zonophora calippus* larva: habitus from an exuvia. Based on Belle (1966c).

Key to the adults of the genus *Progomphus* in South America

Information for the key was provided by Needham and Etcheverry (1955-56), Belle (1966a, 1973, 1975a, 1984b, 1994a, 1995b, c), and DeMarmels (1983a).

1. Basal subcostal cross vein is lacking in both wings (**Fig. 3.2.624**).2
- Basal subcostal cross vein is normally present in at least one wing (**Fig. 3.2.625**).9

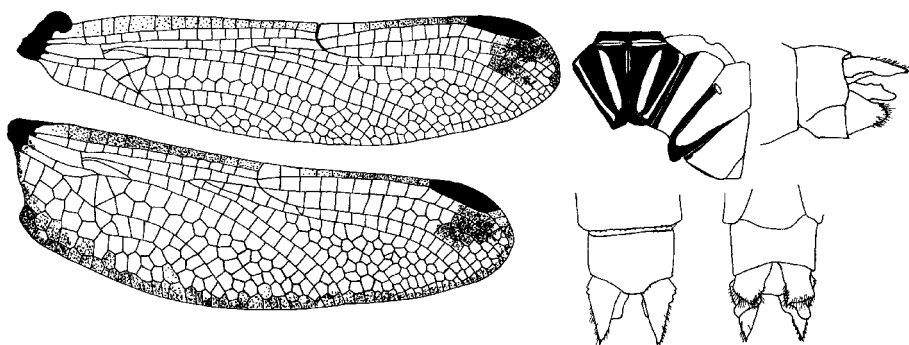


Fig. 3.2.624 *Progomphus auropictus*: fore and hind wing (left), diagram of the color pattern on the thorax of a male (upper right center), and the apex of the abdomen of a male in dorsal (lower right center), ventral (lower right), and lateral view (upper right). Based on Ris (1911c).

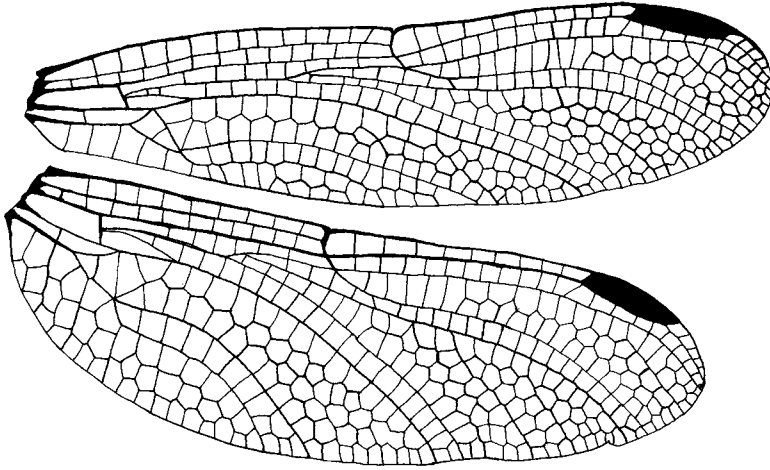


Fig. 3.2.625 Fore and hind wing of a female *Progomphus brachycnemis*. Based on Belle (1966a).

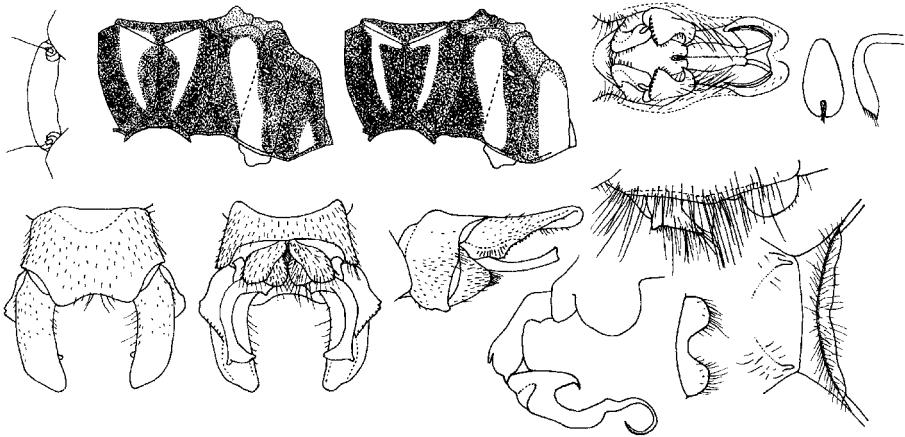


Fig. 3.2.626 *Progomphus gracilis* (upper row, left to right): frons of a male; diagram of the color pattern on the synthorax of a male and a female; male genitalia on the second abdominal segment in ventral (above) and lateral view (below); penis guard in ventral and lateral view, and (below, left to right): apex of the male abdomen in dorsal, ventral, and lateral view; penis in lateral view, vulvar lamina on the ninth abdominal segment of a female in ventral view, and posterior part of vertex and occipital plate of a female in dorsal view. Based on Belle (1973).

2. There are two complete pale antehumeral stripes. The synthorax is pale laterally with three brown lateral stripes; the brown interpleural and metapleural stripes are often reduced. The inferior caudal appendage of the male is brownish yellow (**Fig. 3.2.624**).3

- There is one pale antehumeral stripe, sometimes accompanied by a pale antealar spot. The prothorax is brown or dark brown laterally with two pale stripes. The pale metepimeral stripe is often reduced. The inferior caudal appendage of the male is dark brown or blackish brown (**Fig. 3.2.626**).5

3. The midlateral and femoral stripes on the synthorax are not well developed. The occiput is about ten times as broad as its length along the midline. The apices of the branches of the inferior anal appendages are narrow at the tip (**Fig. 3.2.627**). Total length of male: 37 mm. Abdomen length of male: 28 mm. Hind wing length of male: 24 mm. Costal margin of pterostigma of male fore-wing: 3.6 mm. Coloration of male: mainly brownish yellow and brown with black, yellow, and green markings. The female has not been described.

.....*Progomphus microcephalus* Belle, 1994 (Brazil).

- Midlateral and femoral stripes on the synthorax are well developed. The occiput is not more than about six times as broad as its length along the midline (**Fig. 3.2.624**).4

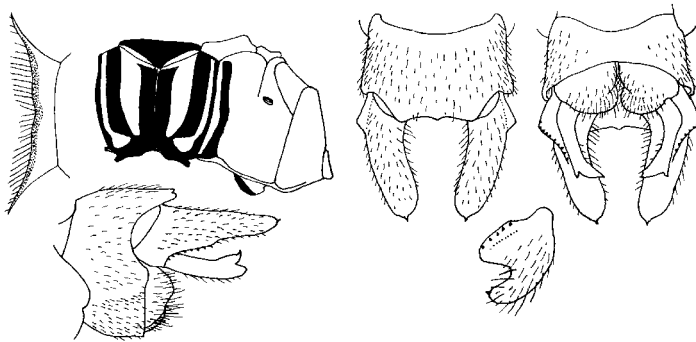


Fig. 3.2.627 *Progomphus microcephalus* male (above, left to right): occipital plate, diagram of the color pattern on the synthorax, apex of the abdomen in dorsal and ventral view, and (below, left and right, respectively): apex of the abdomen in lateral view, and posterior genital hamule in ventral view. Based on Belle (1994a).

4. The wings have a diffuse yellow spot posterior to the pterostigma. The superior caudal appendages of the male taper gradually to an acute point (**Fig. 3.2.624**).

.....*Progomphus auropictus* Ris, 1911 (Argentina).

- The wings lack a diffuse yellow spot posterior to the pterostigma. The superior anal appendages of the male are blunt at the tip (**Fig. 3.2.628**). Total length of male: 41.5 mm. Hind wing of male: 24.5 mm. Female unknown.

.....*Progomphus virginiae* Belle, 1973
(Santa Catarina).

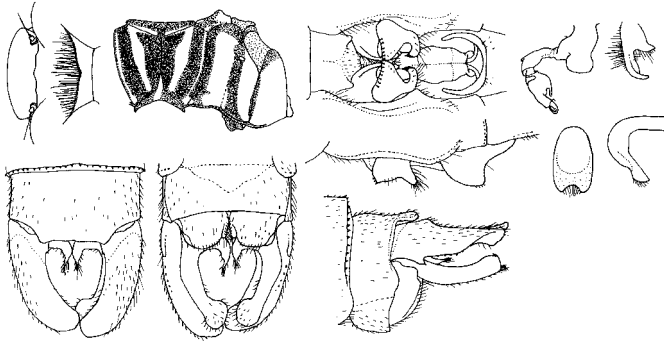


Fig. 3.2.628 *Progomphus virginiae* male (upper row, left to right): frons in dorsal view, occipital plate, diagram of the color pattern on the synthorax, genitalia in the second abdominal segment in ventral (above) and lateral view (below), penis in lateral view, anterior genital hamule in lateral view, and the penis guard in ventral (lower right center) and lateral view (lower right), and the apex of the abdomen in dorsal, ventral, and lateral view (lower left to center, left to right). Based on Belle (1973).

5. The hind tarsus is usually $\frac{3}{4}$ the length of the hind tibia. The first pale antehumeral stripe of the male is broad and confluent with the pale area of the collar; its upper portion is wedge-shaped and tapering. The basal externolateral dilations of the superior anal appendages of the male are much expanded and conspicuous. The vertex of the female has a pair of postocellar spines (**Fig. 3.2.626**).6

- The hind tarsus is only $\frac{2}{3}$ the length of the hind tibia. The first pale antehumeral stripe of the male is narrow, parallel-sided, and joined with the pale area of the collar at the lateral edge. The basal externolateral dilations of the superior anal appendages of the male are small and inconspicuous with a pointed apical inferior angle. The vertex of the female lacks postocellar spines (**Fig. 3.2.629**).7

6. The basal exterolateral dilation of the superior anal appendage of the male reaches caudad to the midpoint of the branches of the inferior anal appendage. The postocellar spines of the female are short (**Fig. 3.2.626**). Total length: 39 to 42 mm. Hind wing: 22 to 28 mm.

.....*Progomphus gracilis* Hagen in Selys, 1854
(Rio de Janeiro, São Paulo).

- The basal exterolateral dilation of the superior anal appendage of the male is greatly enlarged and reaches caudad to the superoexternal anteapical tooth of the branch of the inferior anal appendage. The postocellar spines of the female are reclined to far beyond the anterior margin of the occipital plate (Fig. 3.2.630). Total length: 37.5 to 38 mm. Hind wing: 23 to 24.5 mm.

.....*Progomphus adaptatus* Belle, 1973
(Espirito Santo, São Paulo).

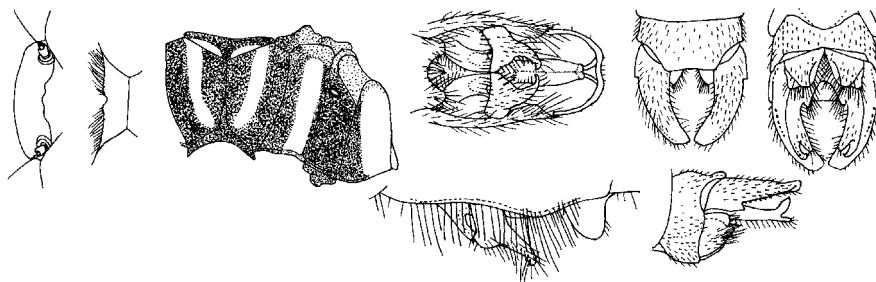


Fig. 3.2.629 *Progomphus elegans* male (left to right): frons in dorsal view, occipital plate, diagram of color pattern on the synthorax, genitalia on the second abdominal segment in ventral (above) and lateral view (below), and the apex of the male abdomen in dorsal, ventral (above), and lateral view (below). Based on Belle (1973).

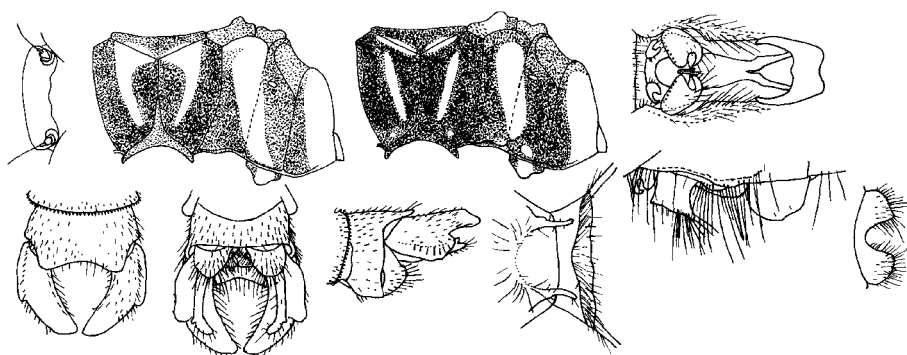


Fig. 3.2.630 *Progomphus adaptatus* (upper row, left to right): frons of a male; diagram of the color pattern on the synthorax of a male and a female; male genitalia on the second abdominal segment in ventral view; and (lower row, left to right): apex of the male abdomen in dorsal, ventral, and lateral view; posterior part of vertex and occipital plate of a female in dorsal view, male genitalia on the second abdominal segment in lateral view, and the vulvar lamina. Based on Belle (1973).

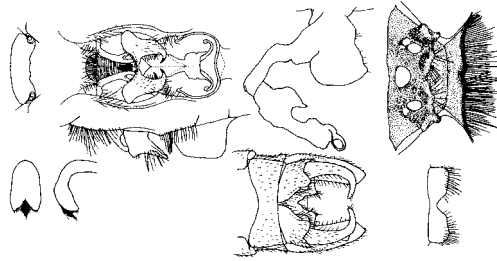


Fig. 3.2.631 *Progomphus lepidus* (above, left to right): frons of a male in dorsal view, male genitalia in the second segment of the abdomen in ventral (above) and lateral view (below), penis in lateral view, and the ocellar area of the head and occipital plate of a female in dorsal view, and (below, left to right): the penis guard in anterior and lateral view, the apex of the male abdomen in ventral view, and the vulvar lamina on the ninth sternite of a female in ventral view. Based on Belle (1973).

7. The frons does not form a distinct angle and lacks an anterior ridge (**Fig. 3.2.629**). Total length: 48.5 mm. Hind wing: 24.5 mm. The female has not been described.

.....*Progomphus elegans* Belle, 1973 (Rio de Janeiro).

- The frons forms distinct angles and has an anterior ridge (**Fig. 3.2.631**).8

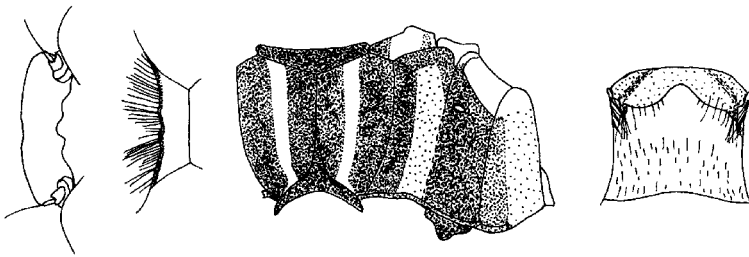


Fig. 3.2.632 *Progomphus australis* female (left to right): frons in dorsal view, occipital plate, diagram of color pattern on the synthorax, and the ninth abdominal segment with the vulvar lamina in ventral view. Based on Belle (1973).

8. The wings are hyaline. Viewed laterally, the inferior anal appendage of the male is stout with long branches that curve sharply inward beyond the supereoexternal anteapical tooth. The posterior genital hamule of the male has an extra internal anteapical tooth. The female has a conspicuous double

protuberance on each postocellar ridge (**Fig. 3.2.631**). Total length: 41 mm. Length of abdomen: c. 29 mm. Hind wing: 20.5 to 24.5 mm.

.....*Progomphus lepidus* Ris, 1911
(Argentina, Uruguay, Santa Catarina, Rio Grande do Sul).

- The wings are brownish yellow in the costal and subcostal fields and at the base of the subtriangle, but not in the anal field. The female has a small tubercle between each postocellar ridge and compound eye (**Fig. 3.2.632**). Total length of female: 37 mm. Hind wing of female: 23 mm. Male unknown.

.....*Progomphus australis* Belle, 1973
(Argentina).

9. There is a colored band along the costa of the wing (**Fig. 3.2.578**).10

- There is no colored band along the costa of the wing. If any part of the costal space is darkened, it is part of a larger dark patch or cloud (**Fig. 3.2.633**).12

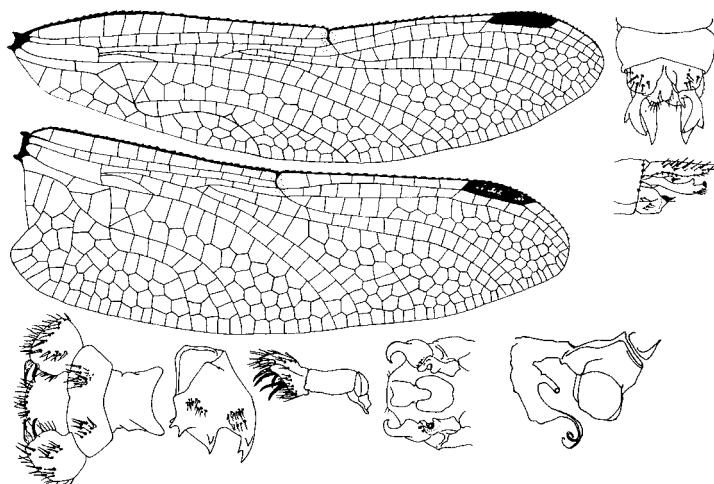


Fig. 3.2.633 *Progomphus herrerae* male: fore and hind wings showing the yellow pterostigma as black (upper left); the apex of the abdomen in ventral (upper right) and lateral view (middle right); and (lower row, left to right): the labium, mandible, maxilla, genitalia on the underside of the second abdominal segment, and penis in lateral view. Based on Needham and Etcheverry (1956).

10. The abdomen of the male is only about 19 mm long, and its hind wing, about 14 mm. The subtriangles and discoidal triangles are not crossed. The trigonal space is filled by only a single row of cells. The branches of the inferior anal appendage curve inward, beginning about 3/5 of the way from the base to the apex (**Fig. 3.2.578**). The female has not been described.

.....*Progomphus perithemoides* Belle, 1980
(Mato Grosso).

- The abdomen of the male is greater than 24 mm long, and the hind wing, longer than 18 mm. The subtriangles and discoidal triangles are usually crossed, and the trigonal space is filled by two rows of cells (**Fig. 3.2.634**).11

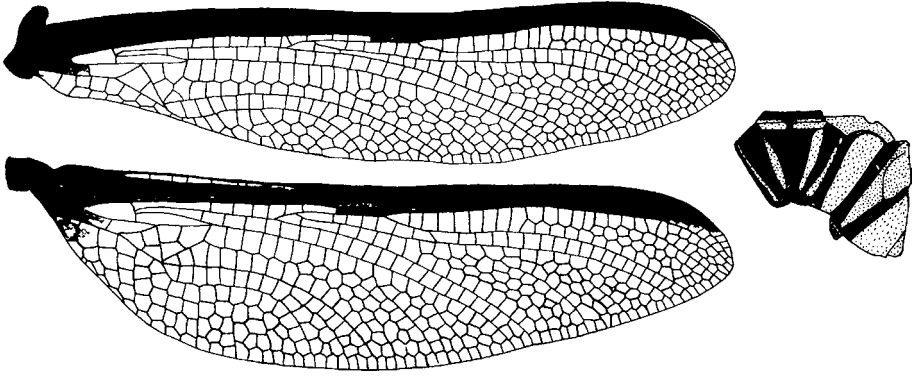


Fig. 3.2.634 *Progomphus costalis* female: fore and hind wing (left); diagram of the color pattern on the pterothorax (right). Based on Ris (1911c).

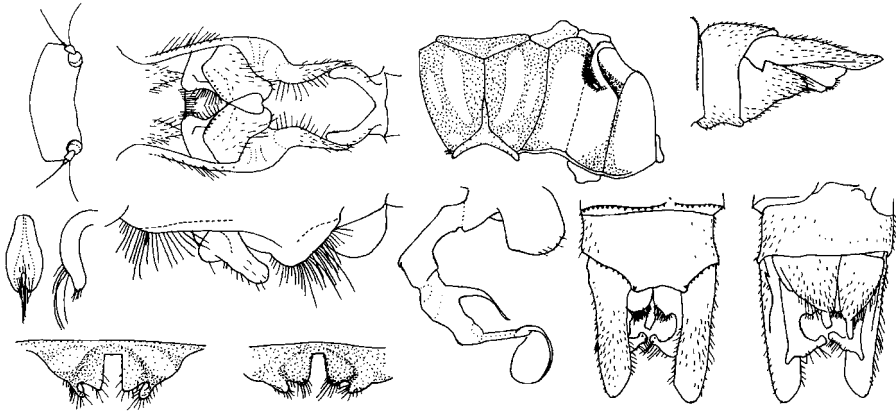


Fig. 3.2.635 *Progomphus aberrans*: frons of a male in dorsal view (upper left), male genitalia on the second abdominal segment in ventral (upper left center) and lateral view (left center), diagram of the color pattern on the synthorax (upper right center), penis guard in anterior and lateral view (middle left, left and right, respectively), penis in lateral view (lower center center), apex of the abdomen of a male in dorsal (lower right center), ventral (lower right), and lateral view (upper right), and the vulvar laminae of two different female specimens (lower left). Based on Belle (1973).

11. The anal appendage of the male is acutely pointed. The stripe across the costal and subcostal areas of the wing is striking (**Fig. 3.2.634**). Length of abdomen: 35 to 37 mm. Hind wing length: 28 to 30 mm.

.....*Progomphus costalis* Hagen in Selys, 1854
(Paraná, Minas Gerais, Santa Catarina, Rio Grande do Sul).

- The anal appendage of the male is bluntly tipped (**Fig. 3.2.635**). Length of abdomen: 29 to 32 mm. Hind wing length: 23 to 24 mm.

.....*Progomphus aberrans* Belle, 1973
(Argentina, Paraguay, Rio Grande do Sul).

12. The wing has a brownish yellow nodal spot, which is sometimes very faint. The pterostigma is light yellow (**Fig. 3.2.633**).13

- There is no trace of a nodal spot on the wing. The pterostigma is not light yellow (**Fig. 3.2.636**).14

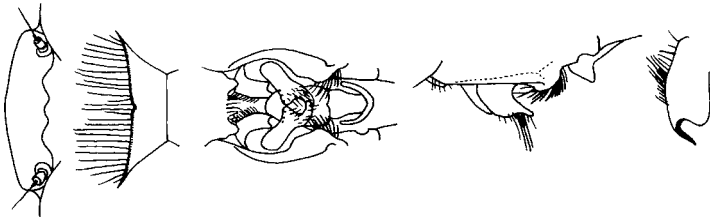


Fig. 3.2.636 *Progomphus perpusillus* male (left to right): frons in dorsal view; occipital plate; genitalia in the second abdominal segment in ventral and lateral view; anterior genital hamule in ventral view. Based on Belle (1973).

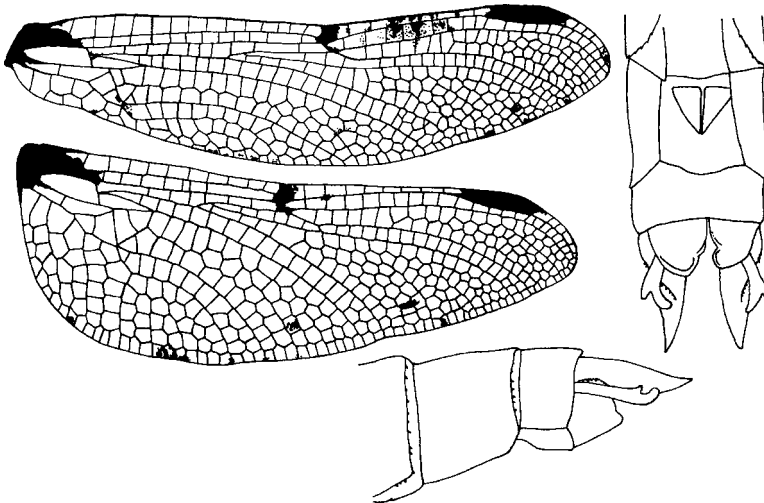


Fig. 3.2.637 *Progomphus joergenseni*: fore and hind wing (upper left), apical segments of the male abdomen in ventral (right) and lateral view (lower center). Based on Ris (1908).

13. The pterostigma of the male is 3.0 to 3.1 mm long; that of the female is 3.6 mm (**Fig. 3.2.637**). Length of male abdomen: 34 to 37 mm. Hind wing of male: 25 to 29 mm. Length of female abdomen: 31 to 38 mm. Hind wing of female: 28 to 32 mm.

.....*Progomphus joergenseni* Ris, 1908
(Argentina, Bolivia, Peru, Chile).

- The pterostigma of the male is 2.5 to 2.9 mm long; that of the female is 2.7 to 2.9 mm (**Fig. 3.2.633**). Length of male abdomen: 29 to 33 mm. Hind wing of male: 23 to 24 mm. Length of female abdomen: 29 to 31 mm. Hind wing of female: 24 to 25 mm.

.....*Progomphus herrerae* Needham and Etcheverry, 1956
(Chile).

14. The abdomen of the male is only about 18 mm long, and its hind wing, about 14 to 15 mm. The hind tibia is distinctly shorter than the hind tarsus. The anal appendages of the male are narrow, and the superior anal appendage lacks a dilation of the external surface at the base (**Fig. 3.2.636**). The female has not been described.

.....*Progomphus perpusillus* Ris, 1918
(Peru, Amazonas).

- The abdomen is longer than 18 mm, and the hind wing exceeds 15 mm in length. 15

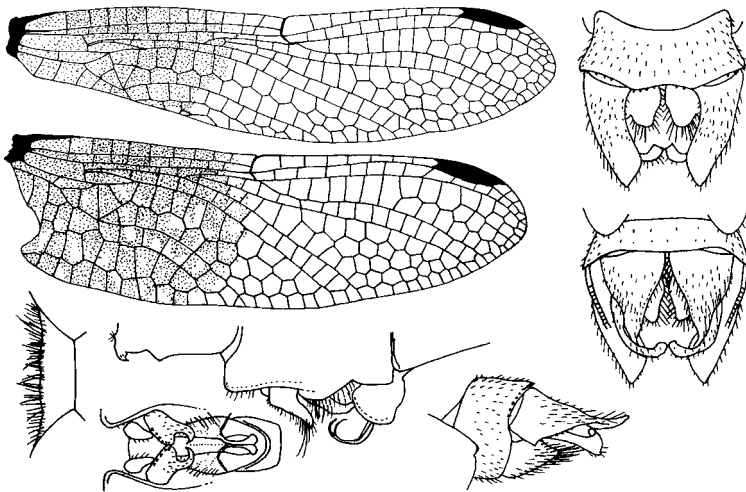


Fig. 3.2.638 *Progomphus maculatus* male: fore and hind wing (upper left), occipital plate (lower left), tubercle on the ventral surface of the first abdominal segment and genitalia on the second segment in lateral view (below hind wing), the genitalia on the second abdominal segment in ventral view (lower left center), and the apex of the abdomen in dorsal (upper right), ventral (middle right), and lateral view (lower right center). Based on Belle (1984b).

15. There is a small ventral tubercle along the midline of the first abdominal segment of the male, and the hind tarsus is slightly longer than the hind tibia. The wings of the male are clouded with yellow brown to or almost to the nodus and hyaline on the apical portion. The pterostigma is brown (**Fig. 3.2.638**). The fore-femur is brown with green on the inner surface. The middle femur is brown, and the hind femur is largely green. Total length: c. 31.5 mm. Length of male abdomen including appendages: c. 23.5 mm. Hind wing length of male: c. 17 mm. The head and thorax of the male are mainly green with blackish and brown setae on the head, an orange brown posterior lobe on the prothorax, and whitish green dorsal stripes on the synthorax. The abdomen is greenish yellow at the base and brown from the middle to the apex. The female has not been described.

.....*Progomphus maculatus* Belle, 1984 (Venezuela).

- Either there is no midventral tubercle or process along the ventral midline of the first abdominal segment of the male (**Fig. 3.2.639**), or the hind tarsus is no longer than about 2/3 as long as the hind tibia. The hind tibia is as long as the hind tarsus or longer.16

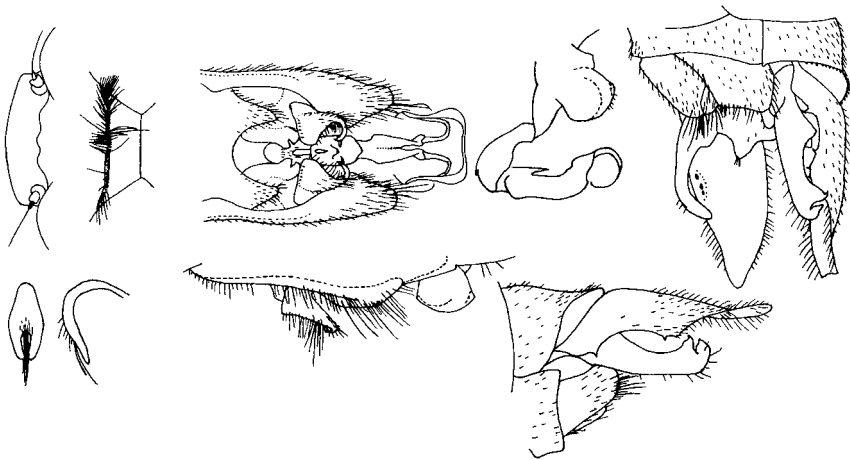


Fig. 3.2.639 *Progomphus amazonicus* male (upper row, left to right): frons in dorsal view, occiput, genitalia on the second abdominal segment in ventral view, penis in lateral view, apex of the abdomen in oblique ventral view, and (lower row, left to right): penis guard in ventral and lateral view, genitalia on the second abdominal segment in lateral view, apex of the abdomen in lateral view. Based on Belle (1973).

16. The hind tarsus is about two thirds as long as the hind tibia or shorter. Some species have a midventral process on the first abdominal segment, which may be small but is always prominent (**Fig. 3.2.640**).17

- The hind tarsus is about three fourths as long as the hind tibia or longer. There is no midventral process on the first abdominal segment (**Fig. 3.2.641**). Various species from North and Central America and the West Indies key out here but usually have a slender midventral process on the first abdominal segment (Belle, 1973). 24

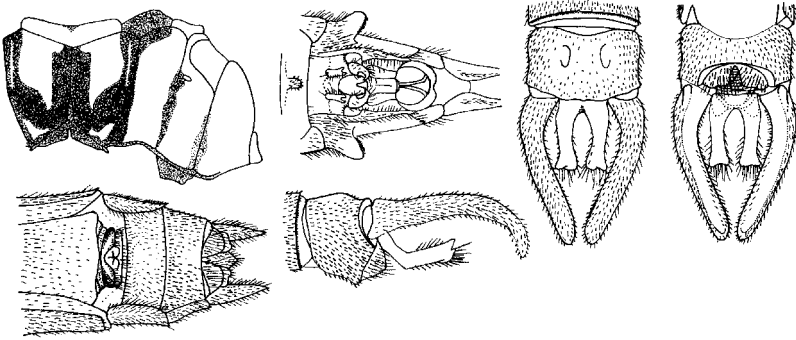


Fig. 3.2.640 *Progomphus pijpersi* (above, left to right): diagram of the color pattern on the synthorax, midventral process on the first abdominal segment and the genitalia on the second in ventral view, and the apex of the male abdomen in dorsal and ventral view, and (below, left and right, respectively) the apex of a female abdomen in ventral view and the apex of the male abdomen in lateral view. Based on Belle (1966a).

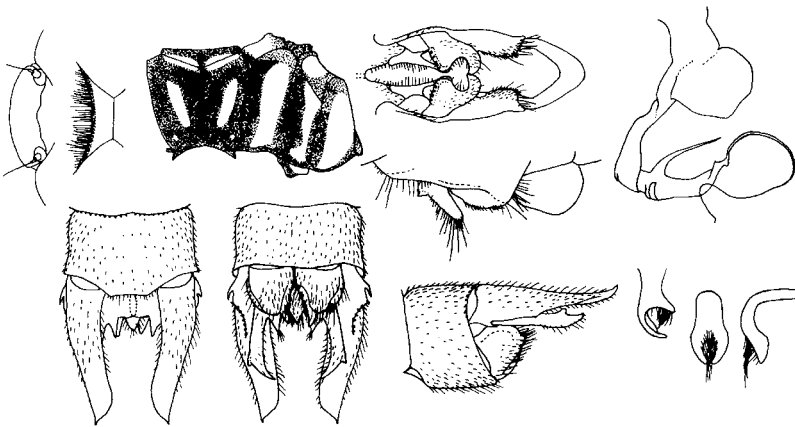


Fig. 3.2.641 *Progomphus boliviensis* male (above, left to right): frons in dorsal view, occipital plate, diagram of the color pattern on the synthorax, genitalia on the second abdominal segment in ventral (above) and lateral view (below), penis in lateral view, and (below, left to right): the apex of the male abdomen in dorsal, ventral, and lateral view, the anterior genital hamule, and the penis guard in anterior and lateral view. Based on Belle (1973).

17. The wings are hyaline. The distal side of the triangle in the fore-wing is bordered by a zig-zag line of veins. The anteriormost of the pale antehumeral stripes reaches to the collar and is wedge-shaped dorsally (**Fig. 3.2.642**). The hind wing of the female is 31 mm long, 10 mm wide, and has five rows of cells posterior to Cu₂; it is nearly as long as the abdomen. Male unknown.

.....*Progomphus polygonus* Selys, 1879 (Venezuela).

- The combination of characters is different (**Fig. 3.2.639**).18

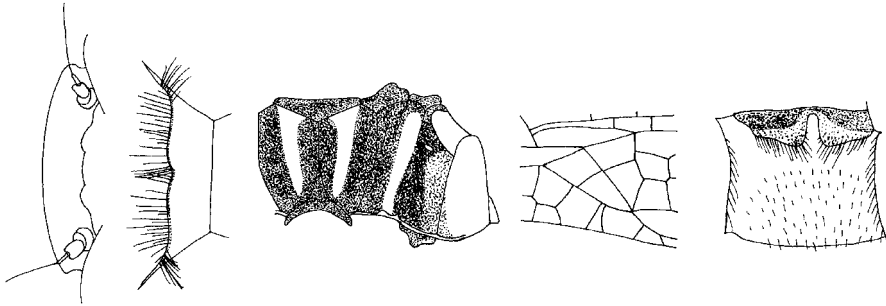


Fig. 3.2.642 *Progomphus polygonus* female (left to right): frons in dorsal view; occipital plate; diagram of the color pattern on the synthorax; triangle, supratriangle, and subtriangle of the fore-wing, and the ninth sternite in ventral view showing the vulvar lamina. Based on Belle (1973).

18. The first abdominal segment has a midventral process. The superior anal appendages of the male are nearly round in cross-section and lack basal externo-lateral dilations and an inferior carina with a row of denticles (**Fig. 3.2.640**).19

- The first abdominal segment lacks a midventral process. The superior anal appendages of the male are flattened into the form of a blade; its inferior carina is denticulated (**Fig. 3.2.639**).21

19. The first abdominal segment has a bean-shaped midventral process covered by stiff hairs. The apex of each superior anal appendage forms an even curve ventrad. The inferior anal appendage reaches only to the midpoint of the superior anal appendage (**Fig. 3.2.640**). Total length: 32 mm. Length of abdomen: 24 mm. Hind wing length: 18.5 mm. Specimens from Surinam are larger (Belle, 1973).

.....*Progomphus pijpersi* Belle, 1966 (Ecuador, Venezuela, Surinam, Rondônia).

- The first abdominal segment forms a conspicuous flap covered by stiff hairs. The apex of each superior anal appendage bends sharply downward in an oblique direction. The inferior anal appendage reaches to a point more than halfway from the base of the superior anal appendage (**Fig. 3.2.643**).20

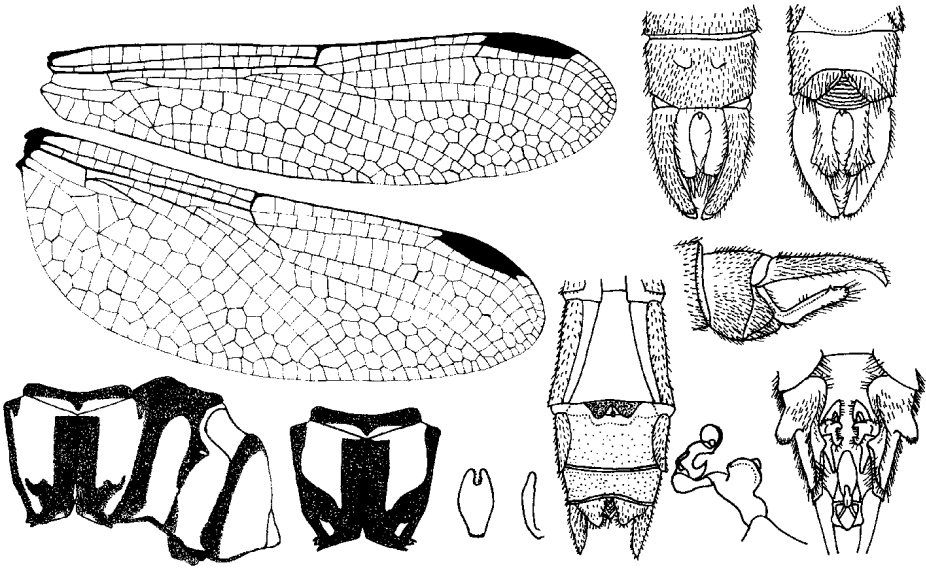


Fig. 3.2.643 *Progompheus geijskesi*: fore and hind wing of a female (upper left); lateral view of the male thorax showing the color pattern (lower left) and a somewhat different pattern on the dorsal side of the pterothorax of a different specimen (lower left center); the apex of the male abdomen in dorsal (upper right center), ventral (upper right), and lateral view (middle right); male genitalia with the penis enlarged to its left (lower right); the apex of the female abdomen in ventral view (lower right center); the penis guard in anterior and lateral view (lower center, left and right, respectively). Based on Belle (1966a).

20. Each discoidal triangle consists of two or three cells. The prothorax is dull brown with green markings on each of the inflated areas of the middle lobe. The synthorax is chocolate brown and grass green with the first and second pale antehumeral stripes being roughly quadratic in shape. The superior anal appendage tapers from the base to the tip and lacks a row of denticles on the ventral side near the apex. The inferior caudal appendage reaches to a point about $\frac{2}{3}$ from the base of the superior anal appendage (**Fig. 3.2.643**). Total length of male: 37.5 mm; length of male abdomen including anal appendages: 29 mm; hind wing length: 19.5 mm.

.....*Progompheus geijskesi* Needham, 1944
(French Guiana, Surinam, Venezuela, Pará, Mato Grosso).

- Each discoidal triangle is open and not divided into cells. The prothorax is dark brown without green markings. The synthorax is dark brown and green with the first and second antehumeral stripes being wedge-shaped. The superior

anal appendage is generally parallel sided from the base to the curve near the tip and has a row of denticles on the ventral side at the apex. The inferior anal appendage reaches a point between halfway and two thirds of the way from the base of the superior anal appendage (**Fig. 3.2.644**). Total length of male: 37 mm; length of male abdomen including anal appendages: 28.5 mm; hind wing length: 20 mm.

.....*Progomphus flinti* Belle, 1975
(Paraguay).

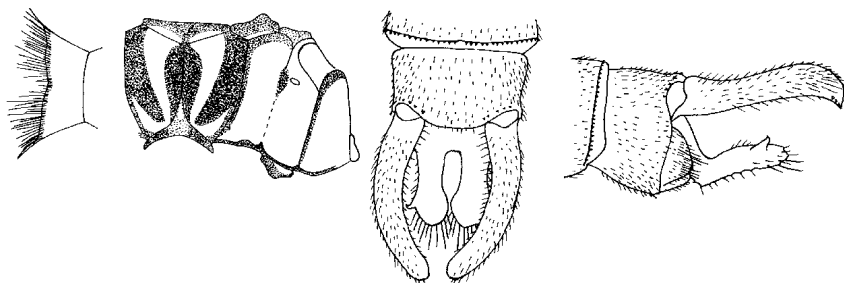


Fig. 3.2.644 *Progomphus flinti* (left to right): occipital plate, diagram of the color pattern on the synthorax, and the apex of the male abdomen in dorsal and lateral view. Based on Belle (1975a).

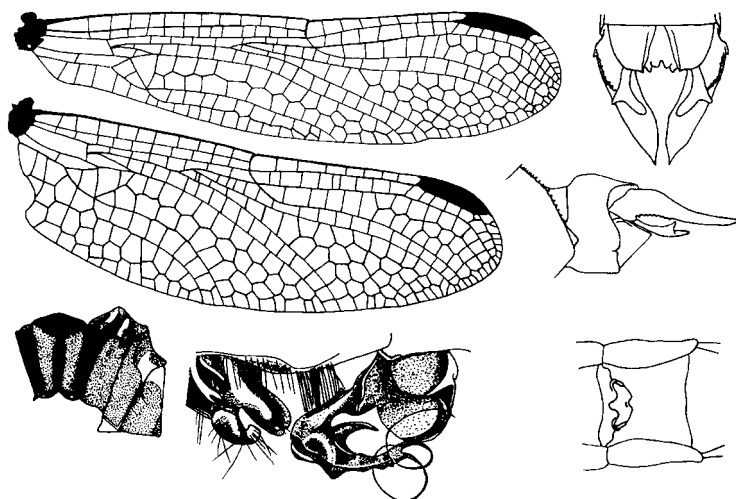


Fig. 3.2.645 *Progomphus pygmaeus*: fore and hind wing of a male (upper left), diagram of the color pattern on the thorax (lower left), lateral view of the male genitalia on the second abdominal segment (lower center), apex of the abdomen of a male in ventral (upper right) and lateral view (middle right), and the vulvar lamina of a female (lower right). Based on Williamson (1920b).

21. The anal field in the fore-wing is one cell wide (**Fig. 3.2.645**). The frons is low. Length of abdomen: 22 to 28 mm. Hind wing length: 18 to 24 mm.22
 - The anal field in the fore-wing is two cells wide. The frons is high (**Fig. 3.2.639**). Length of abdomen: 31 to 39 mm. Hind wing length: 24 to 26 mm.

.....23
 22. The dark midlateral and third lateral stripes of the synthorax are narrow and not connected. The apical part beyond the upper external anteapical tooth of each branch of the inferior anal appendage of the male is straight (**Fig. 3.2.645**). Length of abdomen: 27.5 mm; hind wing length: 21.5 mm. Specimens from Bolivia and Colombia are smaller (Belle, 1973).

.....*Progomphus pygmaeus* Selys, 1873
 (Mexico, Central America, Colombia, Venezuela, Ecuador, Peru, Guyana, Bolivia, Mato Grosso).

- The dark midlateral and third lateral stripes of the synthorax are enlarged and confluent in places. The apical part beyond the upper external anteapical tooth of each branch of the inferior anal appendage of the male is curved caudad (**Fig. 3.2.646**). Total length of male: 32 mm; length of male abdomen: 25 mm; hind wing length of male: 18.5 mm. Female not described.

.....*Progomphus delicatus* Belle, 1973
 (Peru).

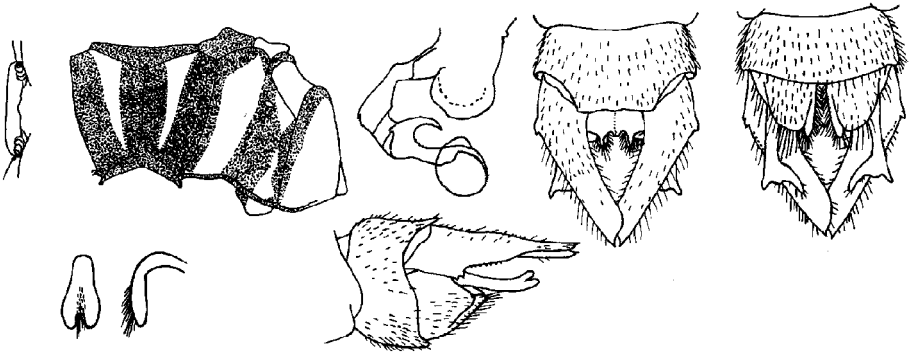


Fig. 3.2.646 *Progomphus delicatus* male (upper row, left to right): frons in dorsal view, diagram of the color pattern on the synthorax, penis in lateral view, apex of the abdomen in dorsal and ventral view, and (below, left to right): penis guard in anterior and lateral view, and the apex of the abdomen in lateral view. Based on Belle (1973).

23. There are three pale lateral stripes on the synthorax. The posterior genital hamules of the male terminate in a single tooth. The lamina tibialis on the fore-tibia of the male is $\frac{1}{3}$ the tibial length. There are three to five denticles on the inferior carina of the superior anal appendage of the male (**Fig. 3.2.639**). Total

length of male: 52 mm; abdominal length of male: 39 mm; hind wing length of male: 26 mm. The female has not been described.

.....*Progomphus amazonicus* Belle, 1973
(Amazonas).

- There are two pale lateral stripes on the synthorax. The posterior genital hamules of the male terminate in two teeth (**Fig. 3.2.647**). The lamina tibialis on the fore-tibia of the male is $\frac{3}{7}$ the tibial length. There are eight to ten denticles on the inferior carina of the superior anal appendage of the male. Total length of male: 18 mm; abdominal length of male: 11.5 mm. The female has not been described.

.....*Progomphus tibialis* Belle, 1973
(Surinam).

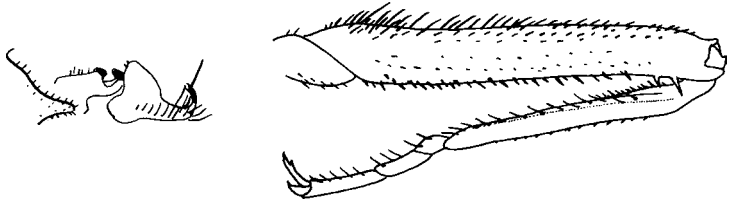


Fig. 3.2.647 *Progomphus tibialis* male: the right genital hamules in ventral view (left) and the outer surface of the hind leg in lateral view (right). Based on Belle (1973).

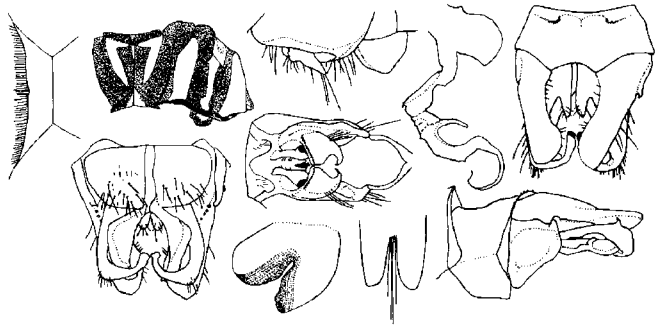


Fig. 3.2.648 *Progomphus racenisi* male (above, left to right): occipital plate, diagram of color pattern on the synthorax, genitalia on the second abdominal segment in lateral view, penis in lateral view, and the apex of the abdomen in dorsal view, and the apex of the abdomen in ventral (lower left) and lateral view (lower right), genitalia in ventral view (center), penis guard in anterior view (lower right center), and the apex of an anterior hamule (lower left center). Based on DeMarmels (1983a).

24. The labrum is entirely pale brown or has a distinct brown marking.25
- If there is any brown mark on the labrum, it is indistinct.43

25. The first pale antehumeral stripe does not reach the semi-collar or merge with its pale area (**Fig. 3.2.641**). 26
- The first pale antehumeral stripe reaches the semi-collar and is confluent with its pale area (**Fig. 3.2.648**).34

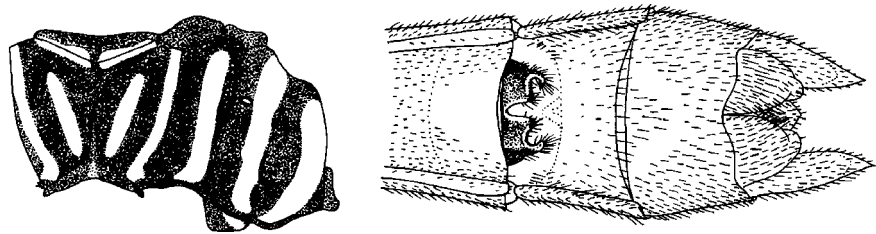


Fig. 3.2.649 *Progompheus conjectus* female: diagram of the color pattern on the synthorax (left) and the apex of the abdomen in ventral view. Based on Belle (1966a).

26. The second pale antehumeral stripe is well developed (**Fig. 3.2.649**). The male has not been described.

.....*Progompheus conjectus* Belle, 1966 (Surinam).

- If present at all, the second antehumeral stripe is very weak and reduced to an antealar spot or a very narrow stripe near the middle of the humeral suture (**Fig. 3.2.641**). 27

27. The second postnodal cell is divided by a cross vein parallel to the costa. The female has a deep pit posterior to each lateral ocellus (**Fig. 3.2.650**). Length of female: 37.5 mm; length of female abdomen: 30.5 mm; hind wing length of female: 23.5 mm. The male has not been described.

.....*Progompheus nervis* Belle, 1973 (Peru).

- The second postnodal cell is not divided by a cross vein parallel to the costa, or the female does not have a deep pit posterior to each lateral ocellus (**Fig. 3.2.651**). 28

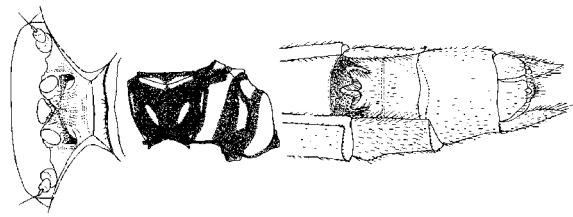


Fig. 3.2.650 *Progompheus nervis* female (left to right): ocellar area of the head in dorsal view, diagram of the color pattern on the synthorax, and the apex of the abdomen showing the vulvar lamina. Based on Belle (1973).

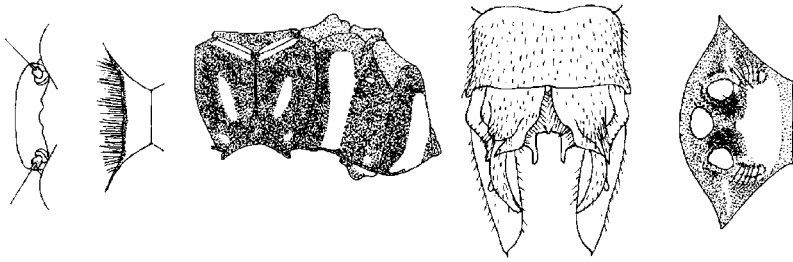


Fig. 3.2.651 *Progompheus formalis* (left to right): frons and the occipital plate of a male, diagram of the color pattern on the synthorax of a male, apex of the male abdomen in ventral view, and the ocellar area on the head of a female in dorsal view. Based on Belle (1973).

28. The distal end of the basal externo-lateral dilation of the superior caudal appendage of the male is not acute (**Fig. 3.2.651**). The caudal appendages of the female are dark or blackish brown with a yellow tip.29

- The distal end of the basal externo-lateral dilation of the superior caudal appendage of the male is very acute (**Fig. 3.2.641**). The caudal appendages of the female are entirely dark or blackish brown.30

29. The length of the costal edge of the pterostigma is about half of the distance between the nodus and edge of the pterostigma. The pale antehumeral stripes are very narrow (**Fig. 3.2.7**). Maximum length of the female: 53 mm; maximum length of the female abdomen: 39.5 mm; maximum hind wing length: 32.5 mm.

.....*Progompheus complicatus* Selys, 1854 (Argentina, Paraguay, Bahia, Espirito Santo, São Paulo, Rio de Janeiro).

- The length of the costal edge of the pterostigma is about one third of the distance between the nodus and edge of the pterostigma (**Fig. 3.2.651**). Total length: 38 to 40 mm; length of abdomen: 29 mm; hind wing length: 24.5 to 26.5 mm.

.....*Progompheus formalis* Belle, 1973 (Ecuador, Peru).

30. The apex of each branch of the inferior anal appendage of the male is strongly curved inward. The postocellar ridges of the female terminate laterally in a distinct tubercle (**Fig. 3.2.13**).

.....*Progompheus guyanensis* Belle, 1966 (Venezuela, French Guiana, Surinam, Maranhão).

- The tip of each branch of the inferior anal appendage of the male curves obliquely posteriad (**Fig. 3.2.641**). The postocellar ridges of the female are gradually reduced in height and become very low laterally.31

31. The exterior margin of the superior anal appendage of the male curves obliquely inward, in dorsal view. The inwardly curving apex of the genital hamule is very narrow. The first abdominal segment has a small but distinct mid-ventral anterior tubercle. The apical process of the anal tubercle of the male

is nearly as long as the anal tubercle itself (**Fig. 3.2.652**). The vulvar lamina of the female is excised along its posterior margin in the form of a U, which is usually approximately 2/3 as long as the lamina.

.....*Progomphus approximatus* Belle, 1966
(Panama, Surinam, Pará).

- The exterior margin of the superior anal appendage of the male curves at least slightly outward, in dorsal view (**Fig. 3.2.641**).32

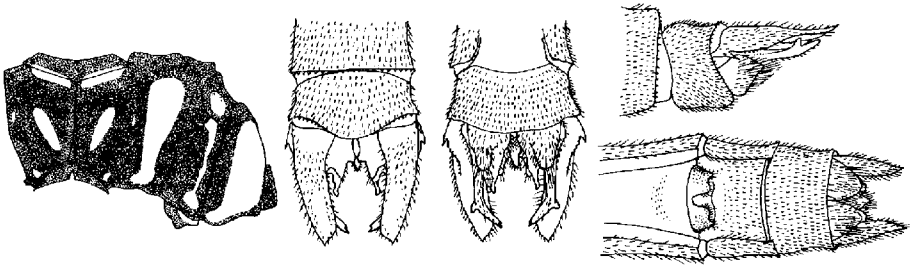


Fig. 3.2.652 *Progomphus approximatus* (left to right): diagram of the color pattern on the synthorax, apex of the male abdomen in dorsal, ventral and lateral view (above), and the apex of a female abdomen in ventral view (below). Based on Belle (1966a).

32. The length of the male abdomen is about 34 mm, and the hind wing length of the male is about 24 mm. The first abdominal segment lacks a ventral tubercle. The apical process of the anal tubercle of the male is shorter than half the length of the main part of the tubercle (**Fig. 3.2.641**). Total length of male: 44 mm. The head and thorax of the male are reddish brown with dull yellow markings. The abdomen of the male is black with narrow dull yellow anterior borders on the anterior segments and dull yellow markings on the ventral surfaces of the seventh, eighth, and tenth segments. The female has not been described.

.....*Progomphus boliviensis* Belle, 1973
(Peru, Bolivia).

- The length of the male abdomen is never much longer than about 26 mm, and the hind wing length of the male does not exceed about 23 mm.33

33. In lateral view, the apical tenth of the superior anal appendage of the male extends beyond the apex of the inferior anal appendage. The middle of the posterior border of the vulvar lamina of the female has a narrow excision along the midline, and laterally, it is extended a considerable distance caudad along the ninth sternite (**Fig. 3.2.653**). Total length of male: 34 mm; female: 35 mm. Length of male abdomen including appendages: 26 mm; female abdomen: 26.5

mm. Hind wing length of male: 20 mm; female: 22 mm. Length of pterostigma along costal margin: 2.8 to 3.0 mm.

.....*Progomphus angeloi* Belle, 1994
(Amazonas).

- In lateral view, the apical fourth of the superior anal appendage of the male extends beyond the apex of the inferior anal appendage. The middle of the posterior border of the vulvar lamina of known females has a wide excision along the midline, and laterally, it does not extend caudad along the ninth sternite (**Fig. 3.2.654**). Total length of female: 34 mm. Length of female abdomen: 25.5 mm. Hind wing length of male: 21 to 23 mm; female: 23 mm. Length of pterostigma along costal margin of fore-wing: 3 mm.

.....*Progomphus nigellus* Belle, 1990
(Rondônia).

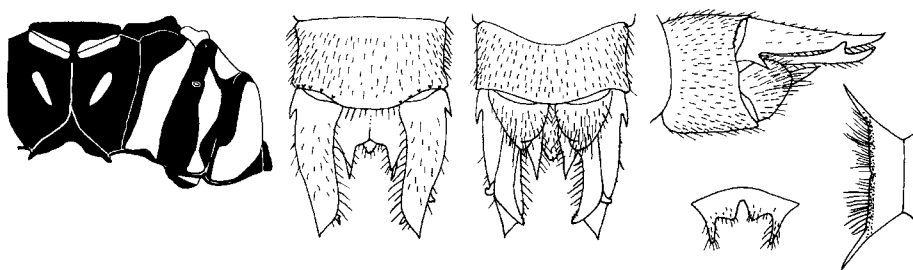


Fig. 3.2.653 *Progomphus angeloi* (left to right): diagram of the color pattern on the synthorax of a male; apex of the male abdomen in dorsal, ventral, and lateral view (above); vulvar lamina of a female (lower right center); occipital plate of a male. Based on Belle (1994a).

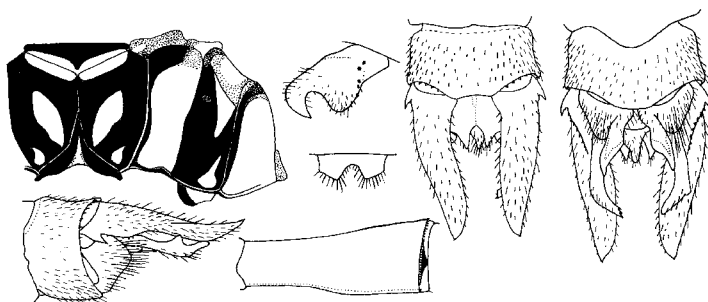


Fig. 3.2.654 *Progomphus nigellus*: diagram of the color pattern on the thorax (upper left); hamulus (upper left center); apex of the male abdomen in dorsal (upper right center), ventral (upper right), and lateral view (lower left); third abdominal segment in lateral view (lower left center); vulvar scale of a female (center). Based on Belle (1990).

34. The first pale antehumeral stripe is somewhat wedge-shaped or fusiform, tapering dorsad from a broad ventral part (**Fig. 3.2.648**).35
 - The first pale antehumeral stripe is not at all wedge-shaped (**Fig. 3.2.655**). ...40

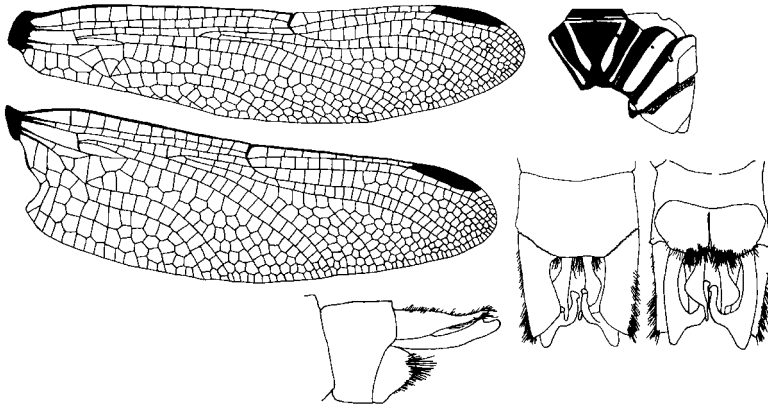


Fig. 3.2.655 *Progomphus recurvatus*: fore and hind wing (left), diagram of the color pattern on the thorax of a male (upper right), and the apex of the abdomen of a male in dorsal (lower right center), ventral (lower right), and lateral view (lower center). Based on Ris (1911c).

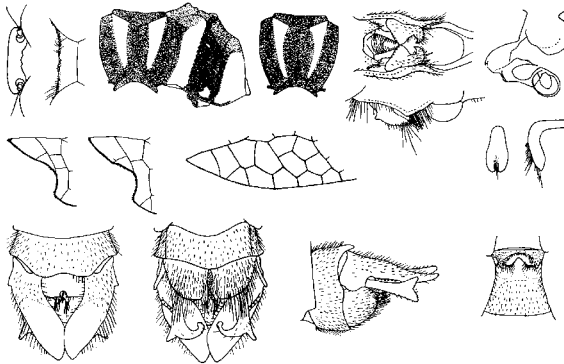


Fig. 3.2.656 *Progomphus anomalus* (upper row, left to right): frons of a male in dorsal view, occipital plate of a male, diagram of the color pattern on the synthorax of a male; pattern on the dorsal surface of the synthorax of a different male specimen, genitalia on the second abdominal segment in ventral (above) and lateral view (below), penis in lateral view, and (middle row, left to right): anal triangle in the hind wing of two different males, anal field in the hind wing of a female, penis guard in ventral and lateral view, and (lower row, left to right): apex of the abdomen of a male in dorsal, ventral, and lateral view; the ninth sternite of a female with the vulvar lamina in ventral view. Based on Belle (1973).

35. The first pale antehumeral stripe is confined to the anterior half of the thorax (**Fig. 3.2.625**). The abdomen is less than 30 mm long, and the hind wing length is less than 22 mm.

.....*Progomphus brachycnemis* Needham, 1944 (French Guiana, Surinam, Venezuela). The Mexican and Central American species. *Progomphus longistigma* Ris, 1916, which keys out here, has a V-shaped notch in the posterior margin of the occipital plate that is absent from the South American species.

- The first pale antehumeral stripe extends from the collar to a point near the antearial sinus (**Fig. 3.2.648**).36

36. The pale metepisternal stripe is absent or weakly developed, often represented by only a dorsal spot. The anal triangle in the hind wing of the male usually consists of two cells (**Fig. 3.2.656**). Total length: c. 34.5 mm. Length of abdomen: c. 26 mm. Hind wing length: c. 22.5 mm. Length of pterostigma in fore-wing: c. 3.3 mm. The male thorax and abdomen are mainly brown with green markings on the thorax and green and yellow markings on the abdomen.

.....*Progomphus anomalus* Belle, 1973 (Panama, Ecuador, Peru).

- The pale metepisternal stripe is well developed (**Fig. 3.2.648**). The anal triangle in the hind wing of the male consists of three cells.37

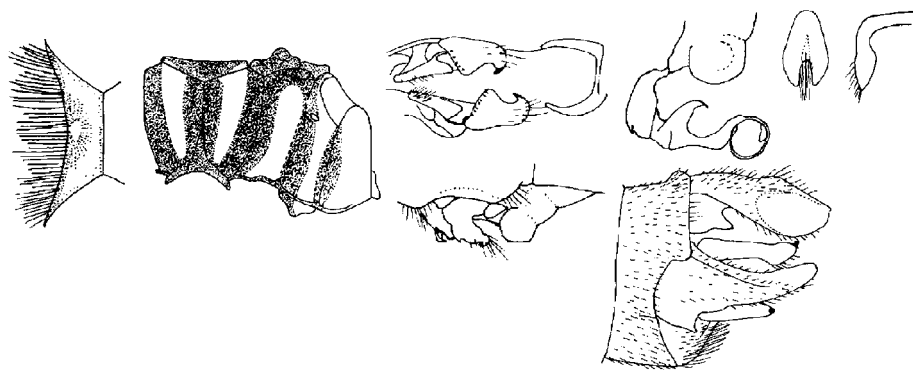


Fig. 3.2.657 *Progomphus abbreviatus* male: occipital plate (left), diagram of the color pattern on the synthorax (left center); genitalia on the second abdominal segment in ventral (upper center) and lateral view (lower center), penis in lateral view (upper right center), penis guard in ventral and lateral view (upper right, left and right, respectively), and apex of the abdomen in oblique ventral view (lower right). Based on Belle (1973).

37. The apical part beyond the supero-external anteapical tooth of each branch of the inferior anal appendage of the male is very reduced or appears to be

absent (**Fig. 3.2.657**). Total length of male: 36 mm; length of abdomen of male: 26 mm; hind wing of male: 25 mm long. The female has not been described.

.....*Progomphus abbreviatus* Belle, 1973
(Ecuador, Colombia, Venezuela).

- The apical part beyond the supero-external anteapical tooth of each branch of the inferior anal appendage of the male is distinct and curved inward (**Fig. 3.2.648**). 38

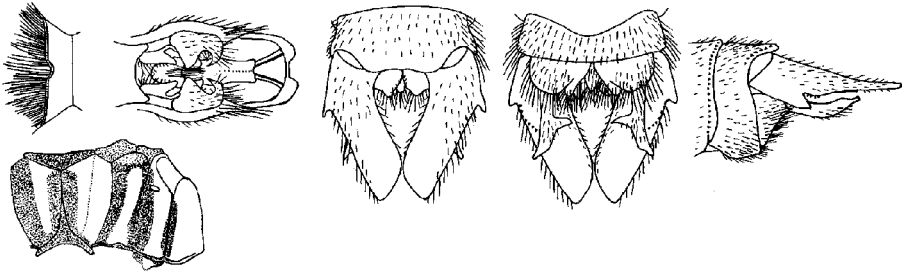


Fig. 3.2.658 *Progomphus occidentalis* male (above, left to right): occipital plate; genitalia on the second abdominal segment in ventral view; apex of the abdomen in dorsal, ventral, and lateral view; and (below) diagram of the color pattern on the thorax. Based on Belle (1983c).

38. Length of male abdomen without appendages: c. 25 mm; hind wing length of male: c. 20 mm. The anteroventral process on the hamule is rounded (**Fig. 3.2.648**). Total length of male: c. 33.6 mm. Coloration of male: head mainly brown with gray and yellow markings; thorax dark brown with black and yellow markings; abdomen: black with yellow markings. The female has not been described.

.....*Progomphus racenisi* DeMarmels, 1983
(Venezuela).

- Length of abdomen: 27 to 33.5 mm; hind wing length: 22.5 to 28.5 mm.39

39. In ventral view, the inner branch on each process of the inferior anal appendage appears to be inserted at about the midlength of the process, and its apex is acute and bears two tiny teeth. The entire outer margin of the superior anal appendage of the male is straight or slightly convex from the basal process to the apex, and it is not emarginate. The apex of the posterior hamule is acutely pointed (**Fig. 3.2.658**). Total length of male: c. 43 mm. Length of male abdomen: c. 33.5 mm. Hind wing length of male: c. 26.5 mm. Length of costal margin of the pterostigma in the fore-wing: c. 3.6 mm. The labrum is entirely pale brown. The synthorax is dark brown with greenish stripes. The female has not been described.

.....*Progomphus occidentalis* Belle, 1983
(Bolivia).

- In ventral view, the inner branch on each process of the inferior anal appendage is broad, appears to be inserted from about 2/3 to 3/4 of the way from the base to the apex, and its apex is broadly truncate and bears a row of tiny teeth. The outer margin of the superior anal appendage of the male is widely emarginate. The anteroventral process on the hamule forms an acutely pointed triangle with an apical angle of nearly 90°. The female has a symmetrical pair of pale lateral spots on the dorsal surface of the frons (**Fig. 3.2.659**). Length of abdomen: 27 to 33.5 mm. Hind wing length: 22.5 to 26 mm.

.....*Progomphus phyllochromus* Ris, 1918
(Ecuador, Peru, Colombia, Venezuela, Bolivia, Argentina).

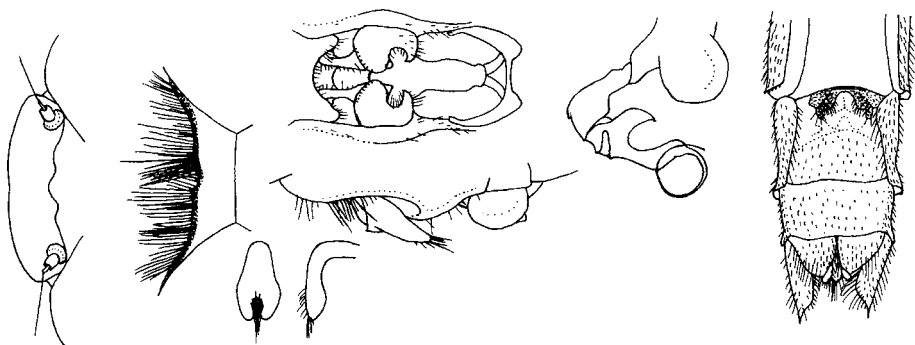


Fig. 3.2.659 *Progomphus phyllochromus*: frons of a male in dorsal view (left), occipital plate of a male (upper left center), male genitalia on the second abdominal segment in ventral (upper center) and lateral view (center), penis guard in anterior and lateral view (lower left center, left and right, respectively), penis (right center) and the apex of the abdomen of a female in ventral view (right). Based on Belle (1973).

40. There is a second pale antehumeral stripe (**Fig. 3.2.655**).

.....*Progomphus recurvatus* Ris, 1911
(Espirito Santo).

- The second pale antehumeral stripe is absent or represented only by an antear spot (**Fig. 3.2.660**).41

41. The first pale antehumeral stripe reaches as far posteriad as the antear sinus and expands along it (**Fig. 3.2.660**). Total length: 43 mm; length of abdomen: 32 mm; hind wing length: 23.5 mm. Female not described.

.....*Progomphus incurvatus* Belle, 1973
(Peru, Venezuela). Two subspecies have been described: *Progomphus incurvatus incurvatus* Belle, 1973; and *Progomphus incurvatus bivittatus* DeMarmels, 1991.

- The first pale antehumeral stripe does not reach as far posteriad as the antealar sinus and is separated from it by its own width (**Fig. 3.2.661**). The labrum is entirely brown.42

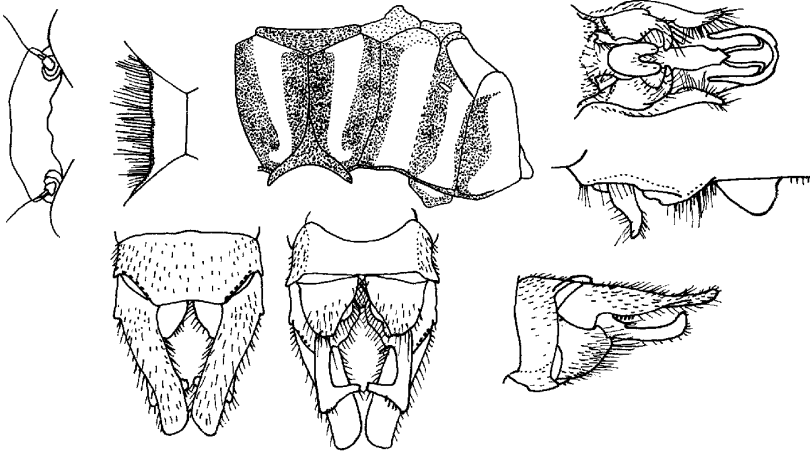


Fig. 3.2.660 *Progomphus incurvatus* male (upper row, left to right): frons in dorsal view, diagram of the color pattern on the synthorax, the genitalia on the second abdominal segment in ventral (above) and lateral view (below), and (lower row, left to right): apex of the abdomen in dorsal, ventral, and lateral view. Based on Belle (1973).

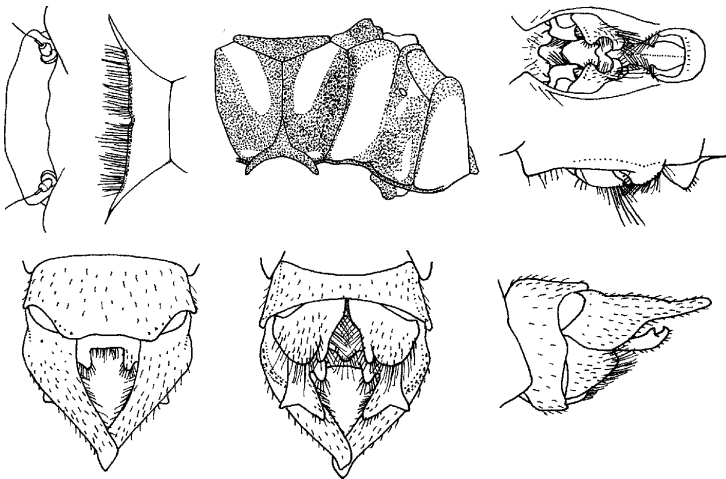


Fig. 3.2.661 *Progomphus tantillus* male (upper row, left to right): frons in dorsal view, occipital plate, diagram of the color pattern on the synthorax, the genitalia on the second abdominal segment in ventral (above) and lateral view (below), and (lower row, left to right): apex of the abdomen in dorsal, ventral, and lateral view. Based on Belle (1973).

42. The wings are hyaline. The inner branches of the subapical fork on each lobe of the inferior anal appendage are only slightly longer than the triangular outer ones (**Fig. 3.2.661**). Total length of male: 32 mm; length of male abdomen: 23.5 mm; hind wing length: 16.5 mm. The female is unknown.

.....*Progomphus tantillus* Belle, 1973
(Bolivia)

- The hind wings are brownish yellow nearly to the pterostigma. The fore-wing has a brownish yellow subcostal band. The inner branches of the subapical fork on each lobe of the inferior anal appendage are much longer than the short, blunt outer ones (**Fig. 3.2.662**). Total length of male: 35 mm; length of male abdomen: 27 mm; hind wing length: 16.5 mm. Only a teneral female has been described.

.....*Progomphus superbus* Belle, 1973
(Ecuador, Venezuela).

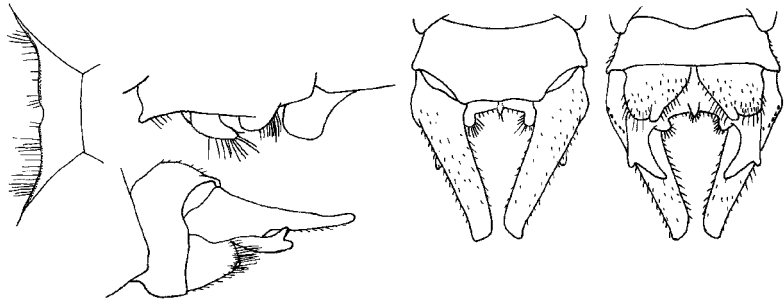


Fig. 3.2.662 *Progomphus superbus* male (left to right): occipital plate, male genitalia on the second abdominal segment in lateral view (above), and the apex of the abdomen in lateral (below), dorsal, and ventral view. Based on Belle (1973).

43. The wings have a blackish brown basal spot, which reaches to the first primary antenodal cross vein.44

- The wings lack a blackish brown basal spot.46

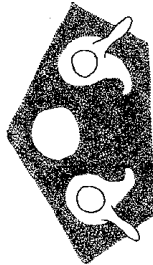


Fig. 3.2.663 The ocellar area on the head of a female *Progomphus victor*. Based on St. Quentin (1973).

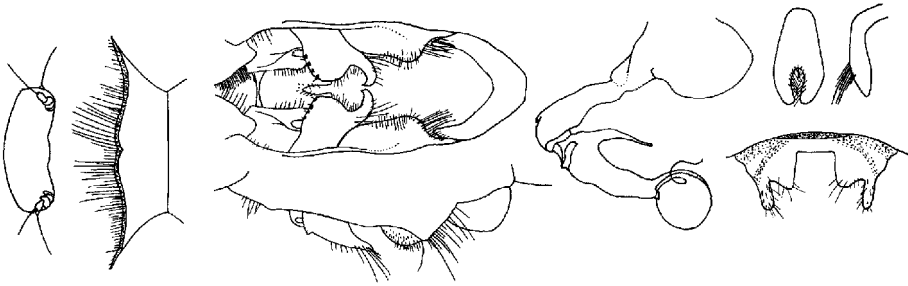


Fig. 3.2.664 *Progompheus basistictus* (left to right): frons in dorsal view, occipital plate, male genitalia on the second abdominal segment in ventral (above) and lateral view (below), penis in lateral view, penis guard in anterior (upper right center) and lateral view (upper right), and the vulvar lamina of a female (lower right). Based on Belle (1973).

44. The vertex of the head is brown with yellow markings surrounding the lateral ocelli. On the outer side of each lateral ocellus of the female, there is a yellow horn directed obliquely posteriad (**Fig. 3.2.663**). Hind wing length: c. 25 mm. Length of pterostigma: c. 4 mm. The male has not been described.

.....*Progompheus victor* St. Quentin, 1973 (Paraná).

- The area of the vertex surrounding the lateral ocelli is brown.45

45. The basal spot on the wing is blackish brown. The apices of the branches of the inferior anal appendages of the male are thick and forked (**Fig. 3.2.664**). There is a wide, U-shaped excision along the midline of the posterior border of the female vulvar lamina, the lateral sides of which extend posteriad along the ninth sternite. Total length of female: 46 mm; length of female abdomen: 34.5 mm; hind wing length: 28 mm.

.....*Progompheus basistictus* Ris, 1911 (Argentina, Paraguay, Santa Catarina).

- The basal spot on the wing is brown. The apices of the branches of the inferior anal appendages of the male curve in to become perpendicular and curve strongly dorsad at their apices. Total length of male: about 39 mm, including anal appendages; length of male abdomen: about 30 mm; hind wing length of male: about 24 mm; pterostigma length along costal margin of fore-wing: 3.2 mm. The female has not been described.

.....*Progompheus basalis* Belle, 1994 (Minas Gerais).

46. The posterior margin of the occiput is convex and has a distinct median excision. The second anal interspace of the hind wing of the female narrows in

the middle and consists of a single row of cells distal from the anal veins (**Fig. 3.2.665**). Total length of female: 48 mm; length of female abdomen: 37 mm; hind wing length: 26.5 mm. The male has not been described.

.....*Progomphus fassli* Belle, 1973
(Amazonas).

- The posterior margin of the occiput is straight and may or may not have a median excision (**Fig. 3.2.666**). 47

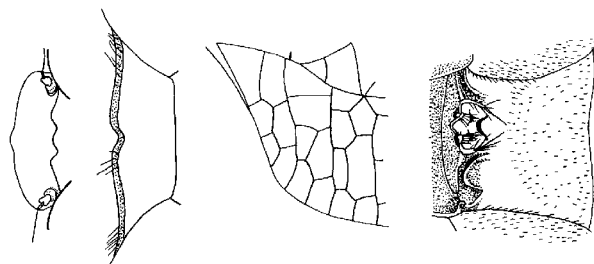


Fig. 3.2.665 *Progomphus fassli* female (left to right): frons in dorsal view, occipital plate, anal region of the hind wing, and the ninth sternite showing the vulvar lamina. Based on Belle (1973).

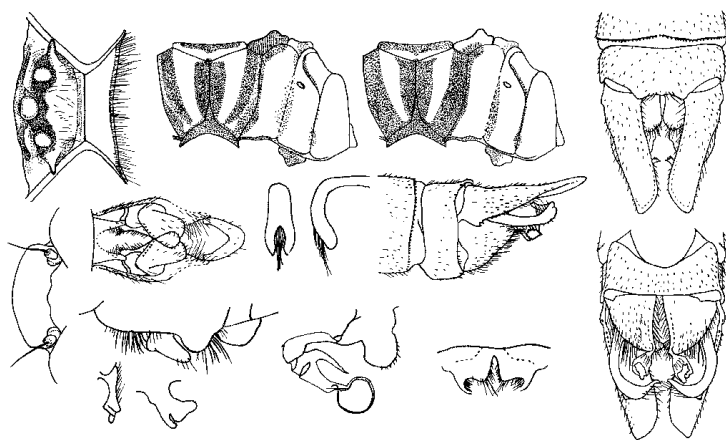


Fig. 3.2.666 *Progomphus montanus* (above, left to right): vertex and occipital plate of a female, diagrams of the color patterns of two males, and the apex of the male abdomen in dorsal view; and the frons of a male (lower left), male genitalia on the second abdominal segment in ventral and lateral view (right of frons, above and below, respectively); penis guard in ventral and lateral view (center, left and right, respectively); penis in lateral view (lower center), anterior hamule in ventral and lateral view (lower left center, left and right, respectively), apex of the male abdomen in ventral (lower right) and lateral view (right center), and the vulvar lamina on the ninth abdominal segment of a female in ventral view (lower right center). Based on Belle (1973).

47. The pterothorax is pale green with indistinct dark markings dorsally. The vulvar lamina of the female has lateral as well as a median excision along the posterior border (**Fig. 3.2.667**). The female is known only from an incomplete specimen,

.....*Progomphus dorsopallidus* Byers, 1934
(Trinidad, Venezuela, Guyana, French Guiana, Brazil).

- The pterothorax is brown or pale brown with distinct pale antehumeral stripes (**Fig. 3.2.666**). 48

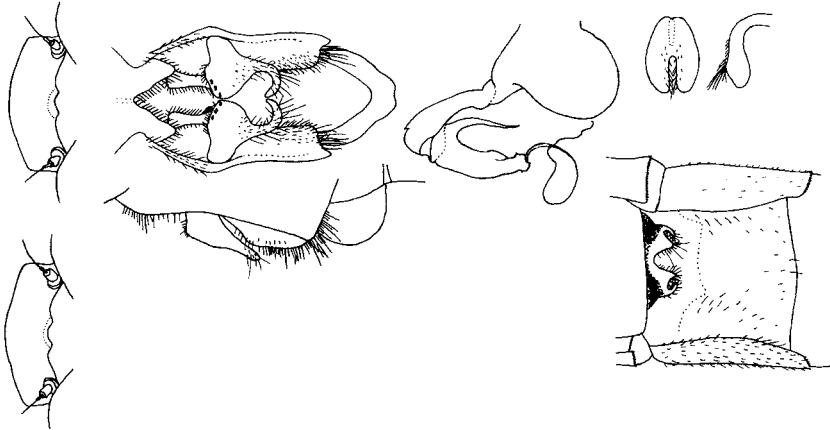


Fig. 3.2.667 *Progomphus dorsopallidus*: frons in dorsal view of a male (upper left) and a female (lower left), male genitalia on the second abdominal segment in ventral (upper left center) and lateral view (lower left center), penis is lateral view (right center), penis guard in anterior and lateral view (upper right, left and right, respectively), and the ninth abdominal segment of a female in ventral view showing the vulvar lamina (lower right). Based on Belle (1973).

48. The first pale antehumeral stripe does not reach the semi-collar or merge with its pale area (**Fig. 3.2.668**). The branches of the male inferior appendage are black.49

- The first pale antehumeral stripe reaches the semi-collar and is confluent with its pale area (**Fig. 3.2.666**).50

49. There is a pointed basal dilation on the external, lateral surface of the male superior anal appendage (**Fig. 3.2.654**). The midline of the vulvar lamina of the female has a V-shaped excision with a rounded base that extends for about half the length of the lamina. Total length of female: 34 mm. Length of female abdomen: 25.5 mm. Hind wing length of male: 21 to 23 mm; female: 23 mm. Length of pterostigma along costal margin of fore-wing: 3 mm.

.....*Progomphus nigellus* Belle, 1990
(Rondônia).

- There is no pointed basal dilation on the external, lateral surface of the male superior anal appendage. The branches of the anal appendages of the male are yellow. The dark color of the thorax is dark brown or black, and the first antehumeral stripe is not confluent with the pale collar (**Fig. 3.2.668**). The female has not been described.

.....*Progomphus recticarinatus* Calvert, 1909
(Argentina, Mato Grosso).

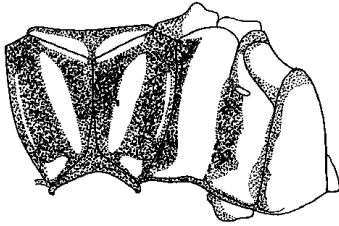


Fig. 3.2.668 Diagram of the color pattern on the sythorax of *Progomphus recticarinatus*. Based on Belle (1973).

50. The pterostigma is 3.8 to 4.3 mm long. The lateral keel on the seventh abdominal segment of the male greatly widens on the apical half. The postocellar ridges of the female have a lateral spine near the edge of the eye. The inferior anal appendages of the male have narrow processes that curve strongly inward toward their apices (**Fig. 3.2.669**). 51
- The pterostigma is 2.8 to 3.3 mm long. 52

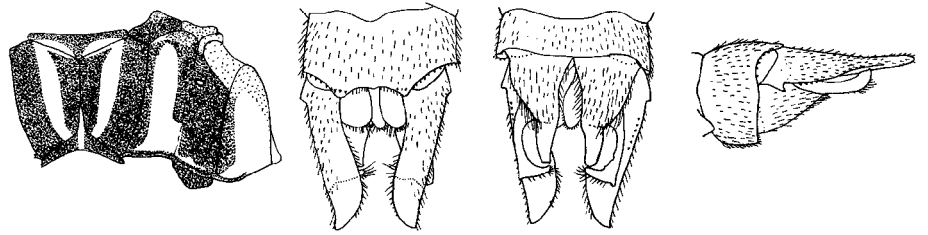


Fig. 3.2.669 *Progomphus kimminsi* male (left to right): diagram of the color pattern on the synthorax and the apex of the male abdomen in dorsal, ventral, and lateral view. Based on Belle (1973).

51. The pterothorax is mainly green laterally with indistinct brown markings along the metapleural and interpleural sutures (**Fig. 3.2.666**). The wings lack distinct basal spots. Total length: 40 to 43 mm; length of abdomen: 28.5 to 32 mm; hind wing length: 22.5 to 23.5 mm.

.....*Progomphus montanus* Belle, 1973
(Bolivia).

- The pterothorax is brown laterally with two distinct green stripes (**Fig. 3.2.669**), and sometimes the brown midlateral stripes contain green flecks. Each wing has a distinct yellowish brown basal spot that reaches nearly to the first primary antenodal cross vein. Total length: 40.5 mm; length of abdomen: 30 mm; hind wing length: 23 mm. The female has not been described.

.....*Progomphus kimminsi* Belle, 1973
(Argentina).

52. The abdomen is 29 to 34 mm long, and the hind wing length is 23 to 26 mm. There is no triangular basal expansion on the superior anal appendage of the male. The antehumeral processes are very narrow (**Fig. 3.2.670**). The branches on the inferior anal appendages are yellow. The internal apical lobe on the anterior hamule ends bluntly. The seminal vesicle is dark brown. The posterior margin of the female vulvar lamina has a deep, median, U-shaped excision about $\frac{3}{4}$ of the length of the lamina.

.....*Progomphus intricatus* Hagen in Selys, 1858
(Bolivia, Venezuela, Pará, Minas Gerais, São Paulo, Mato Grosso).

- The abdomen is about 25 mm long, and the hind wing length is about 21 mm. There is a triangular basal expansion on the superior anal appendage of the male. The internal apical lobe on the anterior hamule ends in a fork (**Fig. 3.2.671**). The seminal vesicle is pale. The pterostigma in the fore-wing is about 3.3 mm long. The female has not been described.

.....*Progomphus bidentatus* Belle, 1994
(São Paulo).

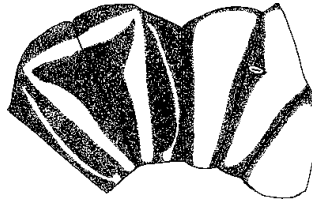


Fig. 3.2.670 Diagram of the color pattern on the thorax of *Progomphus intricatus*. Based on St. Quentin (1973).

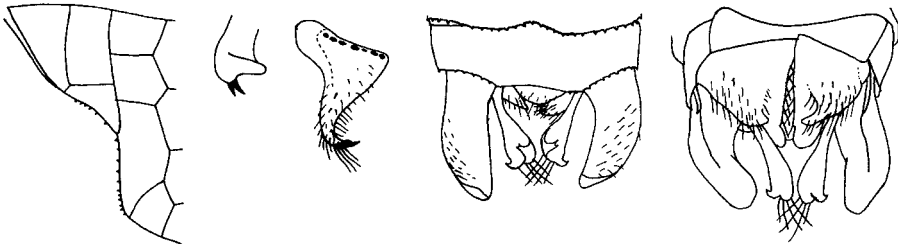


Fig. 3.2.671 *Progomphus bidentatus* male (left to right): anal triangle of the hind wing, anterior hamule, posterior hamule in ventral view, and apex of the male abdomen in dorsal and ventral view. Based on Belle (1994a).

Key to the known *Progomphus* larvae in South America

Information for the key was provided by Belle (1966a, 1973, 1991), DeMarmels (1981d, 1990a, 1991b). The larvae of only a small percentage of the South American *Progomphus* species have been described.

1. The mid-dorsal hooks on the middle abdominal segments are greatly reduced, and the hook on the sixth appears to be vestigial or absent (**Fig. 3.2.672**).2
- The dorsal hooks are well developed on the middle abdominal segments, and a hook is clearly present on the sixth segment (**Fig. 3.2.673**).3

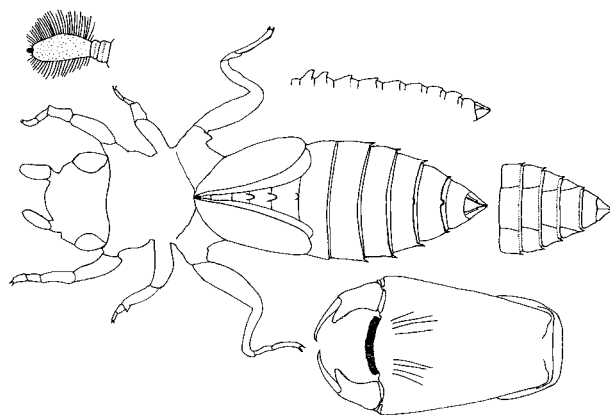


Fig. 3.2.672 *Progomphus anomalus* larva: habitus (lower left), antenna (upper left), labium in ventral view (lower right), profile of the dorsal surface of the abdomen (upper right), and the five apical segments of the abdomen in ventral view (middle right). Based on Belle (1991).

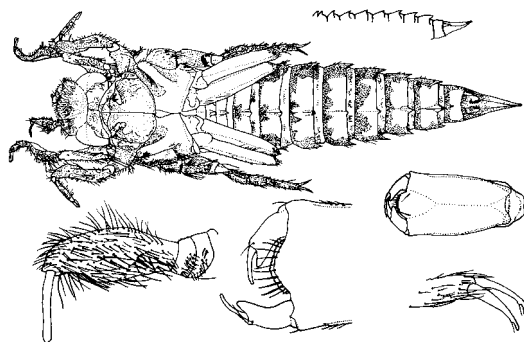


Fig. 3.2.673 *Progomphus racenisi* male larva: habitus from an exuvia with a profile of the dorsal surface of the abdomen above and to the right (above), antenna (lower left), anterior part of the labium in dorsal view (lower center), entire labium in ventral view (middle right), and apex of the hind tarsus with claws (lower right). Based on DeMarmels (1990a).

2. In dorsal profile, the dorsal hook on the third abdominal segment appears only slightly smaller than that on the second and much larger than that on the fourth. In ventral view, lateral sutures are apparent on the ninth segment, as well as those proximal to it (**Fig. 3.2.672**). Total length of final instar: c. 15 mm. The larva is pale brown without a discernible pattern.

..... *Progomphus anomalus* Belle, 1973
(Panama, Ecuador, Peru).

- In dorsal profile, the dorsal hook on the third abdominal segment is obviously much smaller than that on the second and only slightly larger than that on the fourth. There is hardly any sign of a dorsal hook on the fourth through sixth segments (**Fig. 3.2.594**).

..... *Progomphus geijskesi* Needham, 1944
(French Guiana, Surinam, Venezuela, Pará, Mato Grosso).

3. The abdomen is much less than twice as long as its maximum width. The length of the prementum is less than 1.5 times its maximum width. The apical segment of the antenna appears minute compared with the other segments (**Fig. 3.2.674**). Total length of final instar: c. 18 mm.

..... *Progomphus tibialis* Belle, 1973
(Surinam).

- The abdomen is more than twice as long as wide (**Fig. 3.2.673**).4

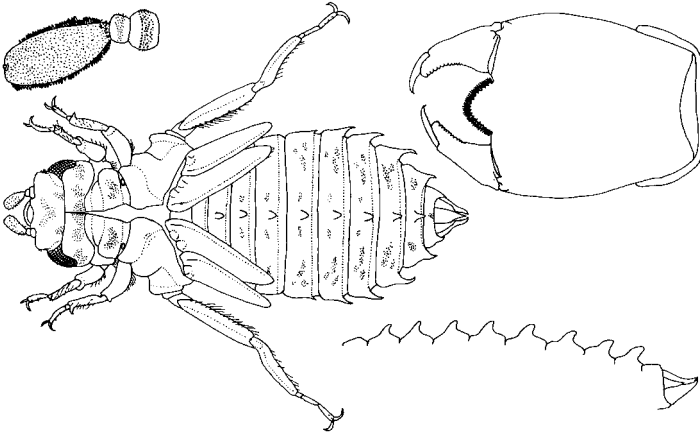


Fig. 3.2.674 *Progomphus tibialis* male larva: exuvia (lower left), antenna (upper left), external view of labium (upper right), dorsal profile of abdomen in lateral view (lower right). Based on Belle (1973).

4. The caudal appendages almost equal, equal, or exceed the length of the seventh, eighth, and ninth abdominal segments, combined. The abdomen is relatively wide, with a pattern of tiny dark spots on a pale background and dark lateral margins on the dorsal surfaces of the abdominal segments, except for the

seventh, which has a large, dark anteromedian marking. The bases of the caudal appendages are dark (**Fig. 3.2.675**).

.....*Progomphus brachycnemis* Needham, 1944
(French Guiana, Surinam, Venezuela).

- The caudal appendages at most only slightly exceed the combined length of the ninth and tenth abdominal segments (**Fig. 3.2.673**).5

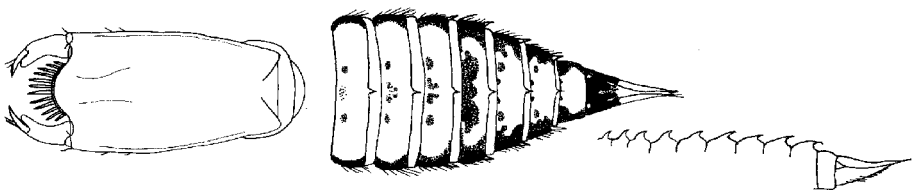


Fig. 3.2.675 *Progomphus brachycnemis* larva (left to right): labium, dorsal view of the abdomen showing the color pattern, and the dorsal outline of the abdomen in lateral view. Based on Belle (1966a).

5. The fourth segment of the antenna is minute in comparison to the other segments; the third segment has a granulate surface and setae arranged in a nearly symmetrical pattern (**Fig. 3.2.676**). There are well-developed burrowing hooks on the fore and middle tibiae.6

- The fourth segment of the antenna is narrow and cylindrical, at least $\frac{1}{4}$ the length of the third segment, which is covered on one side with a dense coat of coarse setae (**Fig. 3.2.673**).7

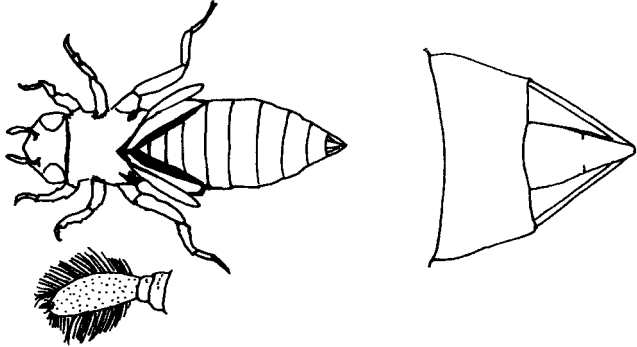


Fig. 3.2.676 *Progomphus pygmaeus* larva: habitus (upper left), antenna (lower left), and the tenth abdominal segment with caudal appendages in dorsal view (upper right). Based on Belle (1991).

6. The total length of the final instar larva is about 14 to 15 mm. The group of caudal appendages is usually slightly shorter than the tenth abdominal segment. The mid-dorsal hooks increase in size progressively from the seventh to the ninth abdominal segments (**Fig. 3.2.677**).

.....*Progomphus pygmaeus* Selys, 1873
(Mexico, Central America, Colombia, Venezuela, Ecuador, Peru, Guyana, Bolivia, Mato Grosso).

- The total length of the final instar larva is about 18 to 19.5 mm. The sides of the prementum are nearly straight. The group of caudal appendages is slightly longer than the tenth abdominal segment. The mid-dorsal hooks on the seventh through ninth abdominal segments are about equal in length (**Fig. 3.2.677**). The color is uniform grayish brown with no obvious markings.

.....*Progomphus abbreviatus* Belle, 1973
(Ecuador, Colombia, Venezuela).

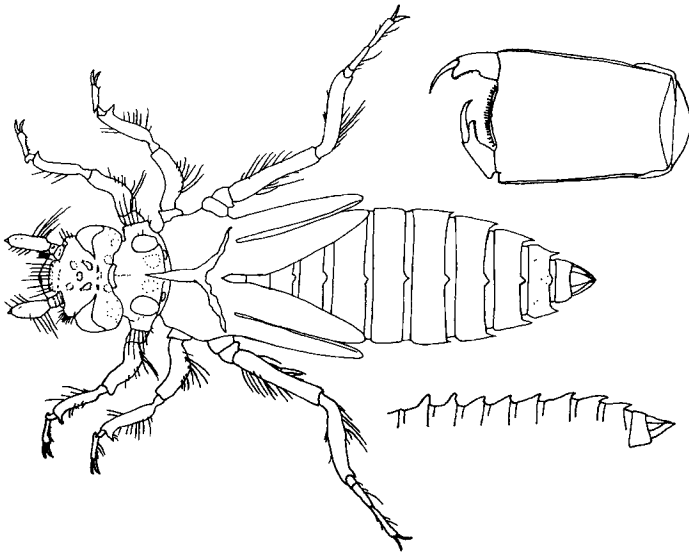


Fig. 3.2.677 *Progomphus abbreviatus* larva: exuvia (middle), labium viewed as it is retracted from the ventral side of the body (upper right), and lateral profile of the dorsal surface of the abdomen (lower right). Based on DeMarmels (1981d).

7. The prementum is about twice as long as its maximum width. The fourth segment of the antenna is more than half as long as the third. The mid-dorsal processes on the fourth through sixth abdominal segments are well formed and curved posteriad (**Fig. 3.2.673**). The tarsal claws have subapical processes, each bearing a strong seta. Total length of final larval instar: 17.5 to 18.0 mm.

.....*Progomphus racenisi* DeMarmels, 1983
(Venezuela).

- The prementum is not more than 1.5 times as long as its maximum width. The fourth segment of the antenna is less than half as long as the third. The mid-dorsal processes on the fourth through sixth abdominal segments are considerably shorter than the others and form only small acute protusions (**Fig. 3.2.678**). 8

8. The prementum is elongate oval and more than 1.5 times as long as its maximum width. The color pattern on the abdomen is largely pale with dark lateral stripes and four small dark spots along the anterior border of each segment from the first to the ninth. The tenth abdominal segment is blackish dorsally (**Fig. 3.2.678**).

.....*Progomphus incurvatus* Belle, 1973 (Peru, Venezuela). Two subspecies have been described: *Progomphus incurvatus incurvatus* Belle, 1973; and *Progomphus incurvatus bivittatus* DeMarmels, 1991.

- The prementum is wedge-shaped and less than 1.5 times as long as its maximum width. There is an elaborate color pattern on the sixth through the ninth abdominal segments (**Fig. 3.2.679**).

.....*Progomphus guyanensis* Belle, 1966 (Venezuela, French Guiana, Surinam, Maranhão).

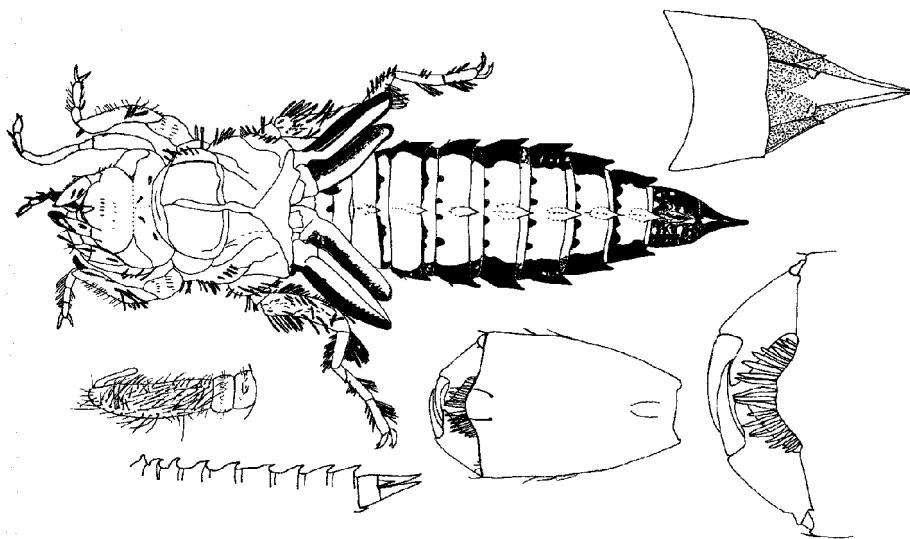


Fig. 3.2.678 *Progomphus incurvatus bivittatus* larva: habitus from exuvia (upper left), antenna (middle left), lateral view of the dorsal margin of the abdomen (lower left), labium in ventral view (lower center), anterior margin of the labium and labial palps in ventral view (lower right), and apex of the abdomen in dorsal view (upper right). Based on DeMarmels (1991b).

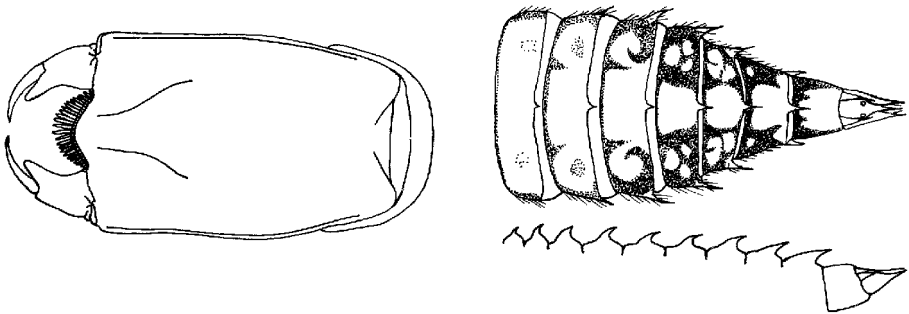


Fig. 3.2.679 *Progomphus guyanensis* larva: labium (left), dorsal view of the abdomen showing the color pattern (upper right), and the dorsal outline of the abdomen in lateral view (lower right). Based on Belle (1966a).

Key to the adults of the genus *Desmogomphus* in South America

Information for the key was provided by Belle (1970a, 1972a). The male and the larva of only one species have been described, so a key to the larvae cannot be provided.

1. The pale antehumeral stripe of the male is not large, and there is a second pale antehumeral stripe just anterior to the humeral suture (**Fig. 3.2.581**). The vulvar lamina covers well over half of the length of the ninth abdominal segment. Only a teneral female has been described.

.....*Desmogomphus paucinervis* (Selys, 1873)
(Central America, Colombia, Ecuador). Syn: probably *Progomphus paucinervis* Selys, 1873.

- The pale antehumeral stripe of the male is relatively large, and a second pale antehumeral stripe just anterior to the humeral suture is absent or indistinct (**Fig. 3.2.680**). The vulvar lamina covers less than half of the ninth abdominal segment of the female. Total length of female: c. 45 mm. Length of female abdomen: c. 34 mm. Hind wing length of female: c. 29 mm. Length of the pterostigma along the costal edge of the wing: c. 3.1 mm in the fore-wing and c. 3.5 mm in the hind wing. The predominant color is brown, and the markings are greenish or yellow. The pterostigma of the female is light brown, and the wing veins are brown.

.....*Desmogomphus tigrivensis* Williamson, 1920
(Guyana, French Guiana, Surinam, Venezuela, Brazil).

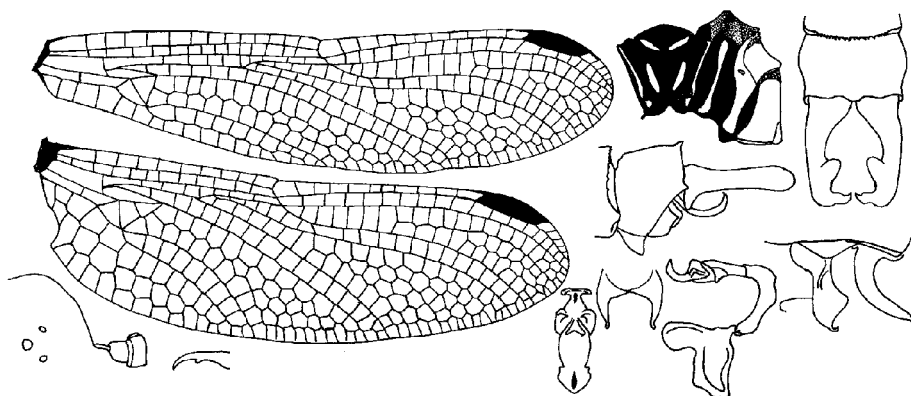


Fig. 3.2.680 *Desmogomphus tigrivensis* (male): fore and hind wing (upper left); color pattern on the thorax (upper right center); relative positions of the ocelli, antenna, and hind tarsal claw (lower left, left to right); apex of the abdomen in lateral view (middle) and in dorsal view showing only the superior appendages (upper right); penis in ventral view, inferior appendages in ventral view, seminal vesicle and penis in lateral view, and the hamules fully extended (lower row on right side, left to right). Based on Williamson (1920a).

Key to the adults of the genus *Diaphlebia* in South America

Information for the key was provided by St. Quentin (1973) and Belle (1972a, 1977b).

1. The middle of the frons is deeply emarginate. The ridge between the relatively large processes behind each ocellus is concave. The dorsal anteriolateral corners of the tenth abdominal segment are deeply impressed (**Fig. 3.2.582**). Length of abdomen of female: c. 39 mm. Hind wing length of female: c. 33 mm. Length of pterostigma in fore-wing measured along the costa: 4.0 mm. The color of the head and thorax of the female is mainly brown with green markings, and the abdomen is mainly black with light brown markings. The green markings on the anterior part of the frons are interrupted in the middle and do not form a complete band.

.....*Diaphlebia angustipennis* Selys, 1854
(Venezuela, Pará, Amazonas, Mato Grosso). Syn: *Zonophora rokitanskyi* St. Quentin, 1973; *Diaphlebia semilibera* Selys, 1869.

- The middle of the frons is slightly concave. The ridge between the low tubercles behind each ocellus is straight. No impressions are evident at the dorsal anterolateral corners of the tenth abdominal segment (**Fig. 3.2.681**). Total length of female: c. 43 mm. Length of abdomen of female: c. 32.5 mm. Hind wing length of female: c. 27.5 mm. Length of pterostigma in fore-wing measured along the costa: 4.5 mm. The green markings on the anterior part of the frons form a complete band.

.....*Diaphlebia nexans* Calvert, 1903
(Mato Grosso?).

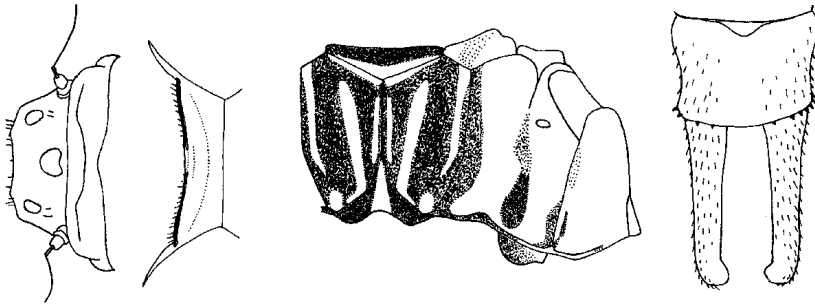


Fig. 3.2.681 *Diaphlebia nexans* male (left to right): vertex and frons in frontal view, occipital plate, diagram of the color pattern on the pterothorax, and apex of the abdomen of a male in dorsal view. Based on Belle (1977b).

Key to male adults in the genus *Aphylla* in South America

Information for the key was provided by Campion (1920), St. Quentin (1967), and Belle (1964b; 1976b, c; 1992b; 1994b). The key is fully applicable only to males, although the females of most species can be recognized from the shape of the vulvar lamina. Belle (1964b) provided illustrations of three *Aphylla* larvae that he identified with the notation “supposition.” He also illustrated the larvae of “*Aphylla albinensis*,” now a synonym of *A. brevipes*, with a question mark beside it (Belle, 1970a). In the absence of newer information and given the questionable nature of Belle’s identifications, no key to the larvae is provided here.

1. The length of the abdomen of the male is about 65 mm. The length of the fore-wing is about 53 mm. The ground color is very dark brown. The costa of both wings is mainly conspicuous yellow. The postclypeus is mainly pale anteriorly. There are two thick, bright blue-green stripes across the pleurae and a pair across the dorsal surface of the pro- and mesonotum. The abdominal tergites have conspicuous green markings along the anterior and posterior margins, which broaden laterally on most segments. The wings are hyaline, and the

pterostigma is pale brown. The superior appendages bear a long fringe of black hairs along their inner margins (**Fig. 3.2.682**). Male chromosome number: $2n = 23$, $n = 12$ (Ferreira *et al.*, 1979).

.....*Aphylla theodorina* (Navás, 1933)
(Venezuela, Guyana, Peru, Argentina, Brazil). Syn: *Gomphoides theodorina* Navás, 1933.

- The length of the abdomen of the male is less than 50 mm, and the fore-wing length, less than 40 mm. The costa of both wings is mainly brown or black, although there may be a yellow line along the frontal margin of the vein (**Fig. 3.2.683**). The postclypeus is brown on its anterior half.2

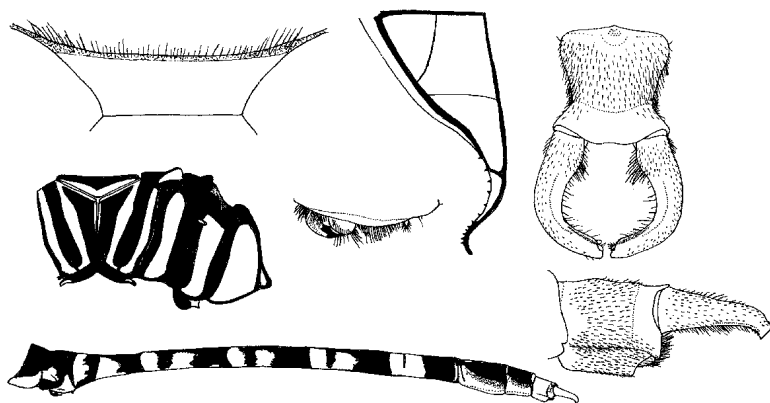


Fig. 3.2.682 *Aphylla theodorina* male: occiput (upper left), anal border of hind wing (upper center), diagram of color pattern on the pterothorax (middle left), lateral view of the genital organs on the ventral side of the second abdominal segment (center), color pattern on the abdomen (lower left), and apex of the abdomen in dorsal (upper right) and lateral view (lower right). Based on Belle (1970a, b).

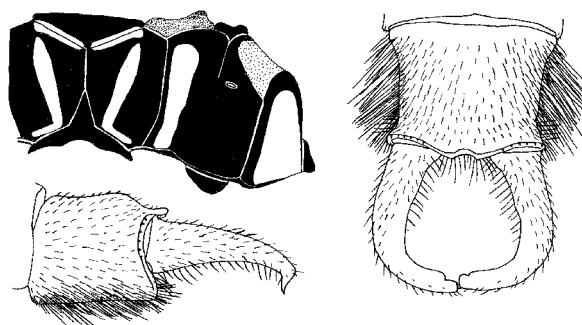


Fig. 3.2.683 *Aphylla barbata* male: diagrammatic depiction of the color pattern on the thorax (upper left), apex of the abdomen in dorsal (right) and lateral view (lower left). Based on Belle (1994b).

2. Either there is no second antehumeral stripe, or it is inconspicuous and sometimes broken into several isolated markings. The first antehumeral stripe is evident and extends along the sinus anterior to the wings (**Fig. 3.2.683**). 3
- Both the first and second antehumeral stripes are plainly evident and may be connected (**Fig. 3.2.684**).5

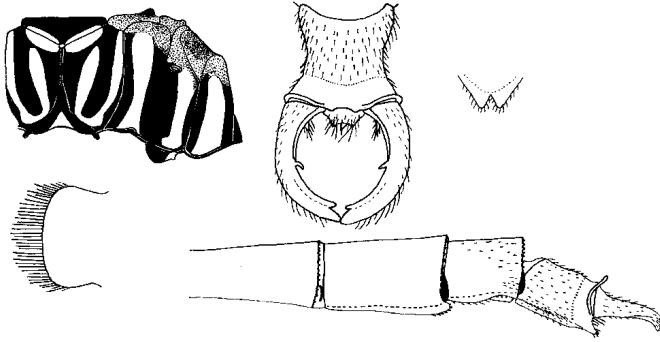


Fig. 3.2.684 *Aphylla spinula*: diagram of the synthorax of a male (upper left), middle lobe of the labium of a male (lower left), apex of the abdomen of a male in dorsal (upper center) and lateral view (lower right), and the vulvar lamina in ventral view (upper right). Based on Belle (1992b).

3. The tenth abdominal segment has a dense ventrolateral fringe of long, stiff, hair-like setae and is somewhat produced ventrad at its ventrolateral apices, and these apices are not produced posteriad or pointed at the apices (**Fig. 3.2.683**).
..... *Aphylla barbata* Belle, 1994 (Amazonas).

- The tenth abdominal segment has no ventrolateral fringe of long, stiff, hair-like setae, although short, hair-like setae may be present. Its ventrolateral apices are produced posteriad and pointed at their apices (**Fig. 3.2.685**).4

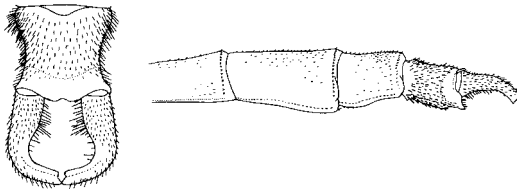


Fig. 3.2.685 *Aphylla alia* male: apex of the abdomen in dorsal view (left) and apical abdominal segments in lateral view (right). Based on Belle (1978).

4. The hind wing is 28 to 30 mm long. The inner margin of each superior anal appendage is straight; it is well rounded at the apex and lacks a “shoulder”

(**Fig. 3.2.685**). Total length of male: 52 to 53 mm. Length of male abdomen: 40 to 41 mm. Length of costal border of pterostigma of male: 3.7 to 3.9 mm.

.....*Aphylla alia* Calvert, 1948
(Guyana, Venezuela).

- The hind wing is 33 to 35 mm long. The inner margin of each superior anal appendage is concave and has an angulation projecting at the apex. The superior anal appendage is thick and has a “shoulder.” The superior anal appendages are bent sharply inward near the middle and bear a strong tooth on the inner surface proximal to the bend. The lateral lobes of the vulvar lamina are broadly rounded (**Fig. 3.2.686**). There are three pairs of pale stripes on the meso and meta-thorax. Length of abdomen: 44 mm.

.....*Aphylla distinguenda* (Campion, 1920)
(Argentina, Paraguay, Brazil). Syn: *Gomphoides distinguenda* Campion, 1920.

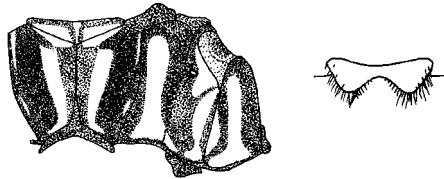


Fig. 3.2.686 *Aphylla distinguenda* female: diagram of the color pattern on the synthorax (left) and the vulvar lamina in ventral view (right). Based on Belle (1972a).

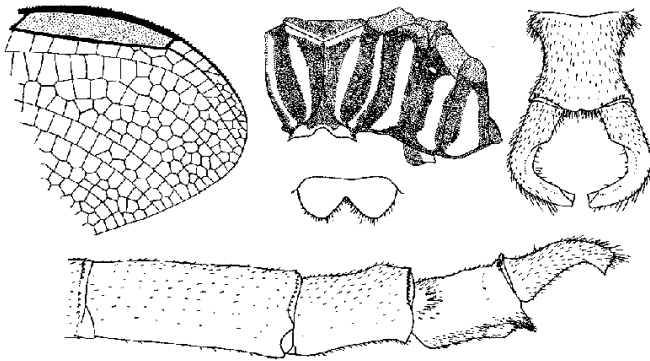


Fig. 3.2.687 *Aphylla robusta* (upper row, left to right): apex of the wing of a male, diagram of the color pattern on the pterothorax of a male, apex of the male abdomen, and (below) lateral view of a male abdomen, and the vulvar lamella of an allotype female (center). Based on Belle (1976b).

5. The superior anal appendages lack “shoulders” (**Fig. 3.2.684**).6
- The superior anal appendages have “shoulders,” although they may not be well developed (**Fig. 3.2.687**).7

6. Each superior anal appendage is curved along its entire length and bears a narrow process near its mid-length. The ventrolateral apices of the tenth abdominal segment are produced posteriad and pointed at their apices (**Fig. 3.2.684**).

..... *Aphylla spinula* Belle, 1992
(Ecuador, Peru).

- Each superior anal appendage is curved strongly toward the midline only along its apical 1/3 and bears no process near its mid-length. The ventrolateral apices of the tenth abdominal segment are somewhat produced posteriad and blunt at their apices. The median incision in the vulvar scale of the female forms approximately a right angle at its base (**Fig. 3.2.688**). The head, thorax, and basal abdominal segments of the male are burnt sienna and reddish brown, and the abdomen is uniform red with blackish superior anal appendages. The proximal portions of the femora of the male are reddish brown, and the apices of the femora, tibiae, and tarsi are black. The wings of the male are hyaline with a slight amber tinge near the apices, and the pterostigma is reddish brown.

..... *Aphylla edentata* Selys, 1869
(Peru, Paraguay, Brazil).

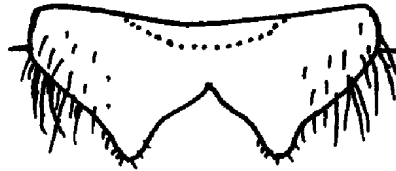


Fig. 3.2.688 The vulvar scale of *Aphylla edentata*. Based on Belle (1972a).

7. The hind wing is longer than 40 mm. 8

- The hind wing is shorter than 38 mm. 9

8. The dark lateral stripes on the pterothorax are wider than the pale stripes (**Fig. 3.2.687**). The color of the tibiae is dark reddish brown. The “shoulders” of the superior anal appendages are well developed. There are denticles on the tenth abdominal segment on its posterior dorsal margin. Total length: 72 to 73 mm. Length of abdomen: 55 to 56 mm. Hind wing length of male: c. 42 mm; female: c. 46.5 mm. Length of pterostigma of fore-wing: 5.5 to 5.6 mm.

..... *Aphylla robusta* Belle, 1976
(Peru).

- The dark lateral stripes on the pterothorax are much narrower than the pale stripes (**Fig. 3.2.689**). The color of the tibiae is black. The “shoulders” of the superior anal appendages are not well developed. There are no denticles on the posterior dorsal margin of the tenth abdominal segment.

..... *Aphylla silvatica* Belle, 1992
(Ecuador).

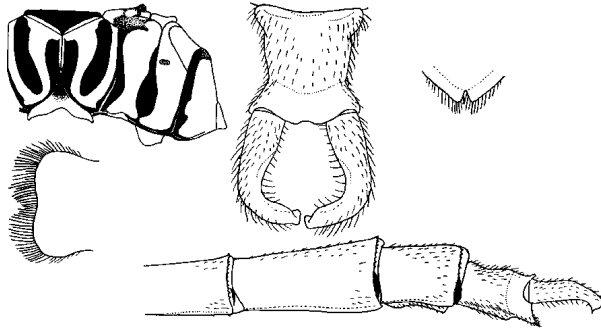


Fig. 3.2.689 *Aphylla silvatica*: diagram of the synthorax of a male (upper left), middle lobe of the labium of a male (lower left), apex of the abdomen of a male in dorsal (upper center) and lateral view (lower right), and the vulvar lamina in ventral view (upper right). Based on Belle (1992b).

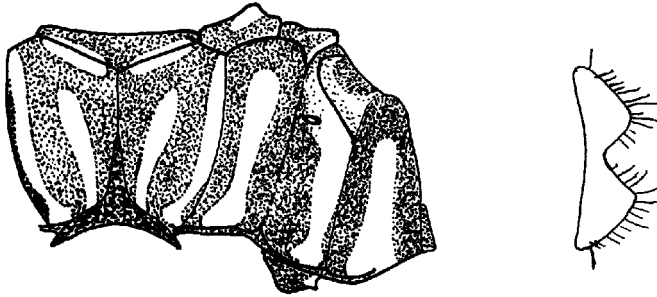


Fig. 3.2.690 *Aphylla molossus* female: diagram of the color pattern on the synthorax (left) and vulvar lamina on the ventral side of the ninth abdominal segment. Based on Belle (1972a).

9. The inner margin of the “shoulder” on each superior anal appendage is concave, and it terminates in a projecting angulation (**Fig. 3.2.690**).10
 - The inner margin of the “shoulder” of each superior anal appendages cercus is straight or nearly so (**Fig. 3.2.691**).11
 10. The “shoulder” of each superior anal appendage is thick, making it appear in dorsal view to become only half as wide apical to the “shoulder.” The ventrolateral apices of the tenth abdominal segment are short and blunt at their apices. The pattern on the synthorax is brown with green stripes (**Fig. 3.2.690**). the femora are brown, but the tibiae are nearly black. Total length of female: c. 59 mm. Length of female abdomen: c. 45 mm. Hind wing length of female: c. 35.5 mm. Length of pterostigma along the costa: c. 4.5 mm.

.....*Aphylla molossus* Selys, 1869
 (Venezuela, Brazil).

- The “shoulder” of each superior anal appendage is narrow, making it appear in dorsal view to become 2/3 as wide apical to the “shoulder.” The superior anal appendages are forcipate with an internal swelling rather than a tooth. The ventrolateral apices of the tenth abdominal segment are long and narrow (**Fig. 3.2.580**). The femora and tibiae are nearly the same shade of brown. There are five pairs of pale stripes on the synthorax. Total length: c. 64 mm. Length of abdomen: c. 49 mm. Hind wing length: 34 to 37 mm. Length of pterostigma along the anterior margin of the costa: 4 to 4.5 mm.

.....*Aphylla dentata* Selys, 1859
(Argentina, Paraguay, Guyana, Surinam, Venezuela, Pará). Syn: *Gomphoides dentatus* (Selys, 1859); *Aphylla simulata* Belle, 1964.

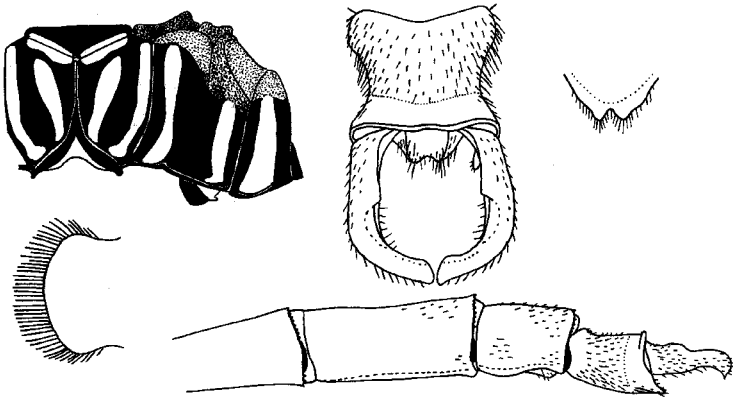


Fig. 3.2.691 *Aphylla scapula*: diagram of the synthorax of a male (upper left), middle lobe of the labium of a male (lower left), apex of the abdomen of a male in dorsal (upper center) and lateral view (lower right), and the vulvar lamina in ventral view (upper right). Based on Belle (1992b).

11. In lateral view, the inner part of the “shoulder” on the superior anal appendage appears elevated. The hind femora and tibiae are nearly the same shade of brown. There are 23 to 24 antenodal cross veins and 15 postnodals in the fore-wing (**Fig. 3.2.691**).

.....*Aphylla scapula* Belle, 1992
(Rondônia).

- In lateral view, the inner part of the “shoulder” on the superior anal appendage is not evident (**Fig. 3.2.692**). 12

12. There is a yellow line along the frontal margin of the costal veins of both wings from the base to beyond the pterostigma. A groove on the internal side of the upper margin of the superior anal appendages is well developed (**Fig. 3.2.692**). An arc greater than 70° separates the lobes of the seminal vesicles.

.....*Aphylla linea* Belle, 1994
(Mato Grosso).

- There is no yellow line along the frontal margin of the costal vein, or if there is one, it does not reach the pterostigma (**Fig. 3.2.693**).13

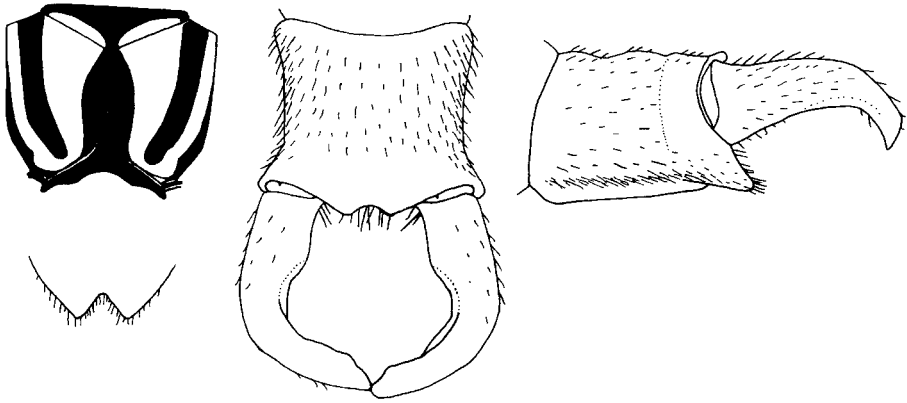


Fig. 3.2.692 *Aphylla linea* male: diagrammatic depiction of the dorsal color pattern on the thorax (upper left), posterior view of the transverse lamella on the seminal vesicle (lower left), apex of the abdomen in dorsal (center) and lateral view (right). Based on Belle (1994b).

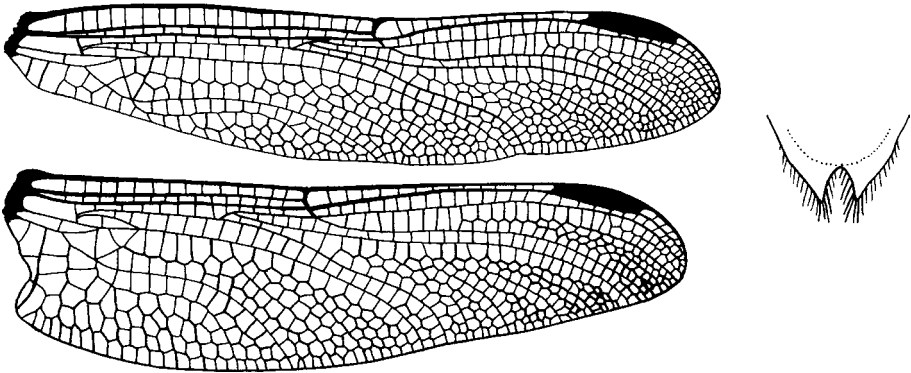


Fig. 3.2.693 *Aphylla producta*: fore and hind wing (left) and vulvar lamina on the ninth abdominal sternite of a female (right). Based on Belle (1970a, 1978).

13. The hind wing is less than 30 mm long. The prothorax is yellow or brownish yellow. The ventrolateral apices of the tenth abdominal segment are produced slightly and directed posteriad (**Fig. 3.2.694**).

.....*Aphylla exilis* Belle, 1994 (Pará).

- The hind wing is longer than 30 mm long. The prothorax is brown, sometimes with yellow dorsal markings (**Fig. 3.2.695**).14

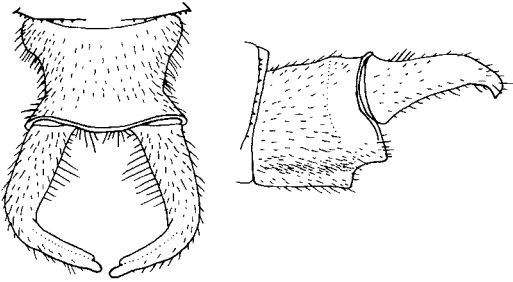


Fig. 3.2.694 *Aphylla exilis* male: apex of the abdomen in dorsal (left) and lateral view (right). Based on Belle (1994b).

14. The ventrolateral apices of the tenth abdominal segment are produced and generally directed ventrad (**Fig. 3.2.695**).
.....*Aphylla janirae* Belle, 1994

(Pernambuco).

- The ventrolateral apices of the tenth abdominal segment are produced and end in an acute point directed posteriad (**Fig. 3.2.696**).15

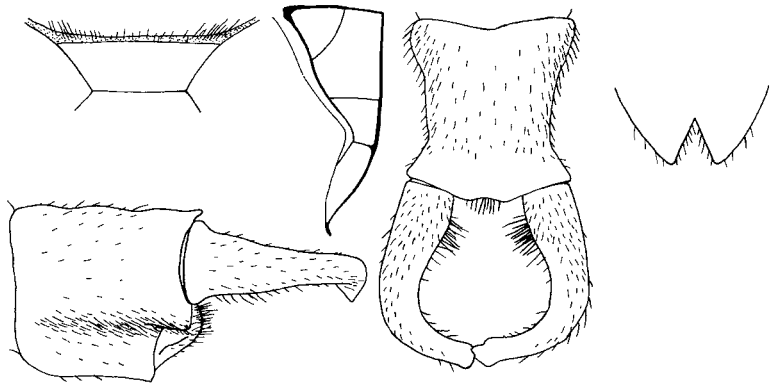


Fig. 3.2.695 *Aphylla janirae* male: occipital plate (upper left), the anal triangle of the right hind wing (upper left center), posterior view of the transverse lamella on the seminal vesicle (right), apex of the abdomen in dorsal (upper right center) and lateral view (lower left). Based on Belle (1994b).

15. The predominant dark color on the body is black. There is a pale posterior cross band across the proclypeus. The posterior dorsal margin of the tenth abdominal segment is straight or slightly concave in the middle. The superior

anal appendages are thick and bear prominent “shoulders,” the distance between them at the base is much less than the width of one appendage (**Fig. 3.2.696**).

.....*Aphylla brasiliensis* Belle, 1970
(Amazonas, Goiás, Mato Grosso).

- The predominant dark color on the body is brown. The apical abdominal segments are sometimes brownish orange. The distance between the superior anal appendages at the base is equal to or greater than the width of one of the appendages (**Fig. 3.2.697**).16

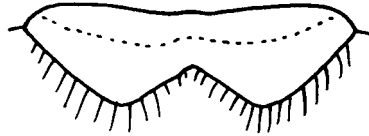


Fig. 3.2.696 *Aphylla brasiliensis* female: vulvar lamina in ventral view. Based on Belle (1992b).

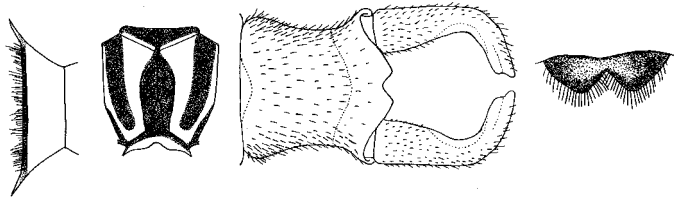


Fig. 3.2.697 *Aphylla tenuis* (left to right): occipital plate of a female, color pattern on the dorsal surface of the synthorax of a male, apex of the male abdomen in dorsal view, and the vulvar lamina of a female. Based on Belle (1977c), who described the species under its synonym, *Aphylla obscura*.

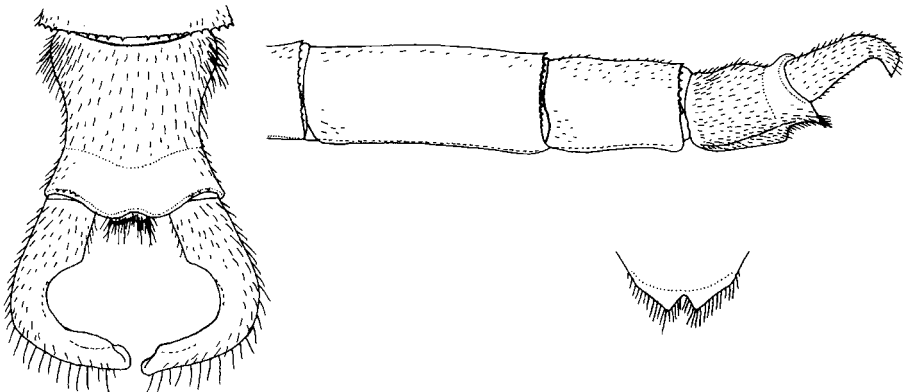


Fig. 3.2.698 *Aphylla boliviana* male: apex of the abdomen in dorsal view (left), apical abdominal segments in lateral view (upper right), and a posterior view of the hood of the peduncle of the penis (lower right). Based on Belle (1978).

16. Lateral dilations from 0.2 to 0.5 mm wide are present on the eighth abdominal segment (**Fig. 3.2.697**).17

- Any lateral dilations present on the eighth abdominal segment are less than 0.15 mm wide (**Fig. 3.2.698**).18

17. The posterior dorsal margin of the tenth abdominal segment has a deep notch in the middle (**Fig. 3.2.697**). The lateral dilations on the eighth abdominal segment are from 0.2 to 0.32 mm wide. Total length of female: c. 56 mm. Length of female abdomen: c. 43 mm. Hind wing length of female: c. 35.5 mm. Length of costal margin of pterostigma of female: c. 4.2 mm.

.....*Aphylla tenuis* Selys, 1859
(Central America, Colombia, Venezuela, Brazil). Syn: *Cyclophylla obscura* Kirby, 1899; *Aphylla elegans* Belle, 1970.

- The posterior dorsal margin of the tenth abdominal segment is slightly concave in the middle (**Fig. 3.2.699**). The lateral dilations on the eighth abdominal segment are from 0.4 to 0.5 mm wide. Abdominal length of male: 42 mm. Hind wing length of male: 32 mm.

.....*Aphylla brevipes* Selys, 1854
(Surinam, French Guiana, Pará). Syn: *Aphylla albinensis* Belle, 1970.

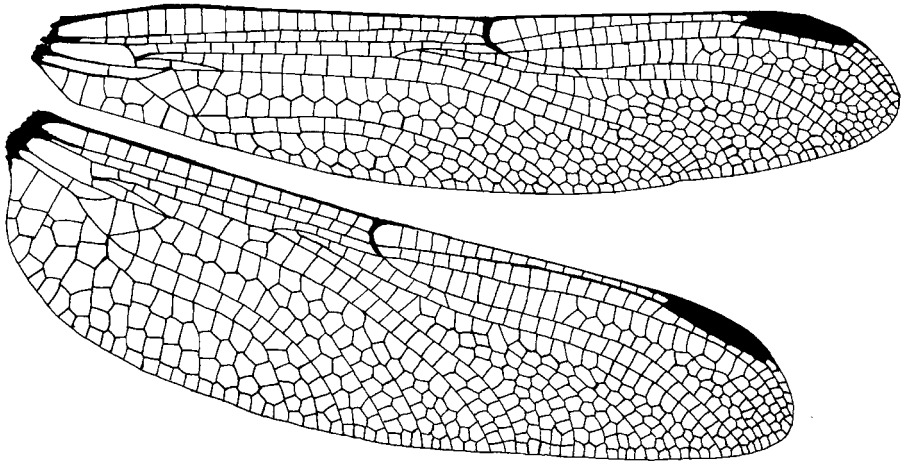


Fig. 3.2.699 The fore and hind wing of a female *Aphylla brevipes*. Based on Belle (1970a), described under the synonym *Aphylla albinensis*.

18. The posterior dorsal margin of the tenth abdominal segment bears denticles above the bases of the cerci. The base of a cercus is much narrower than the distance between the cerci at the base (**Fig. 3.2.698**). Total length of male: c. 64

mm. Length of male abdomen: c. 50 mm. Length of costal border of pterostigma of male: c. 5.0 mm.

..... *Aphylla boliviana* Belle, 1972
(Ecuador, Peru, Bolivia).

- The posterior dorsal margin of the tenth abdominal segment bears few, if any, denticles. The base of one superior anal appendage is as wide or almost as wide as the distance between these appendages at the base (**Fig. 3.2.700**). 19

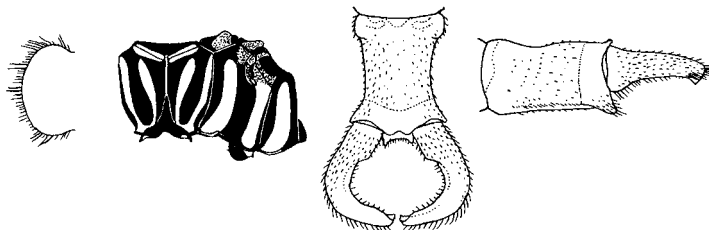


Fig. 3.2.700 *Aphylla caudalis* male (left to right): the margin of the labium, diagram of the color pattern on the synthorax, and apex of the abdomen in dorsal and lateral view. Based on Belle (1987b).

19. The width of the medial excision at the apex of the tenth abdominal segment, measured across the dorsum, is $1/4$ of the length of the segment. The abdomen of the male is shorter than 50 mm and usually about 46 mm long. The ninth abdominal segment is longer than the tenth (**Fig. 3.2.693**). Hind wing length of male: 37 mm. The head and thorax are light reddish brown with ocher yellow diagonal stripes on the thorax. The abdomen of the male is mainly shiny blackish with increasing amounts of reddish on the seventh through tenth segments. The abdomen of the female is uniform reddish brown. The legs of the male are reddish almost to the apices of the femora and then darker. The legs of the female are reddish brown with darker tarsi. The wings are hyaline with a slight amber tinge, and the pterostigma is brown, somewhat darker in the male.

..... *Aphylla producta* Selys, 1854
(Florida?, Cuba?, Trinidad, Guyana, Surinam, Venezuela, Peru, Paraguay, Uruguay, Argentina, Mato Grosso). Syn: probably *Aphylla curvata* (Navás, 1933).

- The width of the medial excision at the apex of the tenth abdominal segment, measured across the dorsum, is $1/5$ of the length of the segment. The ninth and tenth abdominal segments are equally long (**Fig. 3.2.700**). Total length of male: about 67.5 mm. Length of male abdomen: 53 to 54 mm. Hind wing length of male: c. 37 mm. Costal edge of the pterostigma in the fore-wing: 4.5 mm. The female has not been described.

..... *Aphylla caudalis* Belle, 1987
(Pará).

Key to the adult males of the genus *Phyllocycla* in South America

Information for the key was provided by Fraser (1947a), St. Quentin (1967) and Belle (1970a, 1975b, 1988a, 1990).

1. The tenth abdominal sternite has folds directed inward or ventrad at the apical corners (**Fig. 3.2.701**).2
- The tenth abdominal sternite does not have folds directed inward or ventrad at the apical corners (**Fig. 3.2.702**).13

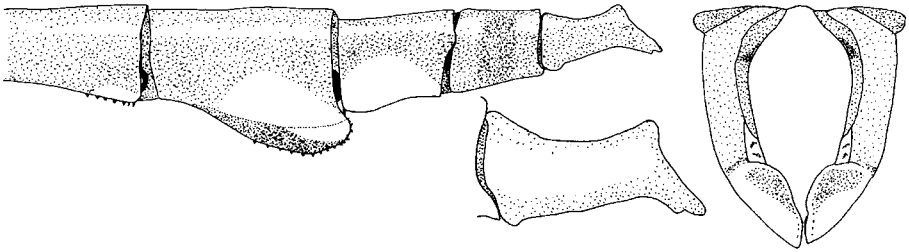


Fig. 3.2.701 *Phyllocycla uniforma* male: apical segments of the abdomen in lateral view (left), superior anal appendage in lateral view (lower center), and both appendages in dorsal view (right). Based on Dunkle (1987).

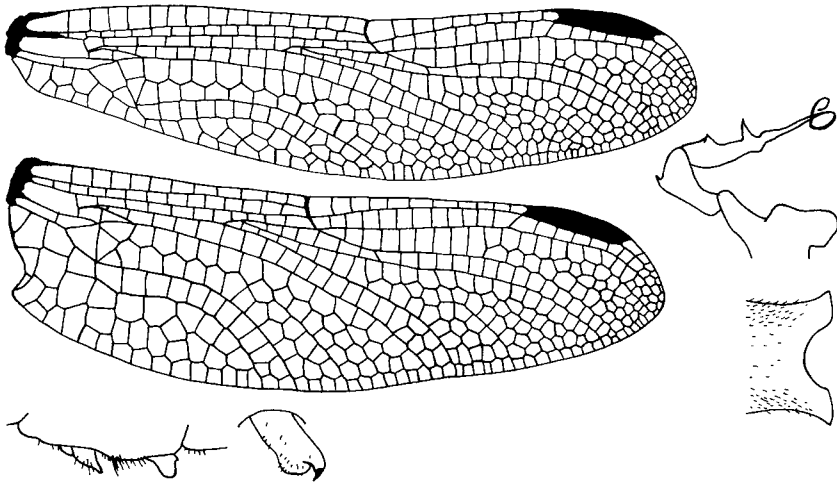


Fig. 3.2.702 *Phyllocycla pegasus*: fore and hind wing of a male (upper left), male genital organs on the ventral side of the second abdominal segment in lateral view (lower left), ventral view of the right posterior hamule (lower left center), penis in lateral view (upper right), and the tenth abdominal sternite of a male (lower right). Based on Belle (1988a).

2. In lateral view, a distinct tooth or prominent angulation is visible where the superior appendage curves ventrad (**Fig. 3.2.701**).3
 - In lateral view, the superior appendage curves evenly ventrad and lacks a distinct tooth or prominent angulation (**Fig. 3.2.703**).8

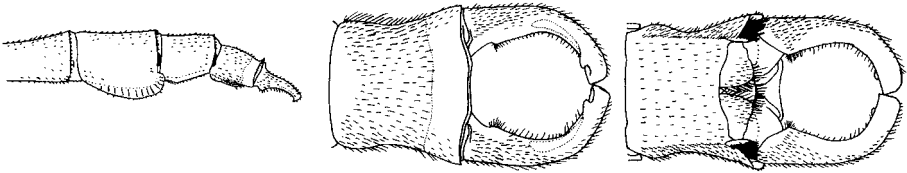


Fig. 3.2.703 *Phyllocycla pallida* male (left to right): apical segments of the abdomen in lateral view and the tenth segment with appendages in dorsal and ventral view. Based on Belle (1970a).

3. On the apical 2/5 of the seventh abdominal segment, the lateral keel widens abruptly. The margin of the occipital plate of the female is nearly straight (**Fig. 3.2.704**). Length of abdomen: 31 to 37 mm. Hind wing length: 25 to 29 mm.
*Phyllocycla anduzei* (Needham, 1943)
 (Trinidad, Colombia, Venezuela, Peru, Ecuador, Bolivia). Syn: *Cyclophylla anduzei* Needham, 1943
 - The lateral keel on the seventh abdominal segment widens gradually near the apex (**Fig. 3.2.701**).4

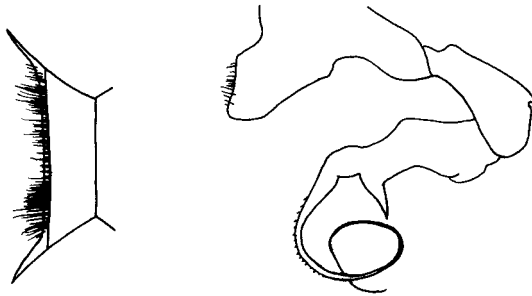


Fig. 3.2.704 *Phyllocycla anduzei* male: occipital plate of a female (left) and penis in lateral view (right). Based on Belle (1988a).

4. The color is pale, and any pattern is faint. The superior appendage is blunt at the apex, which is clearly bifid (**Fig. 3.2.701**). Beware of confusing this with teneral specimens of other species.
*Phyllocycla uniforma* Dunkle, 1987
 (Peru).

- The color is obviously dark with a distinct pattern on the thorax. The superior anal appendage is acute and not bifid at the apex (**Fig. 3.2.705**).5

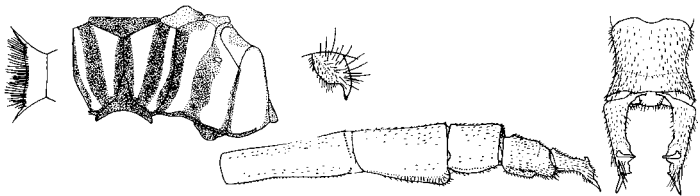


Fig. 3.2.705 *Phyllocycla armata* male (left to right): occipital plate, diagram of the color pattern on the synthorax, posterior genital hamule in ventral view (above), apical segments of the abdomen in lateral view (below), and the apex of the abdomen in dorsal view. Based on Belle (1977d).

5. There is an internal hook on the superior anal appendage between the dorsal tooth and the apex (**Fig. 3.2.705**).6
- There is no internal hook on the superior anal appendage between the dorsal tooth and apex (**Fig. 3.2.706**). The labrum is uniformly blackish brown or brown.7

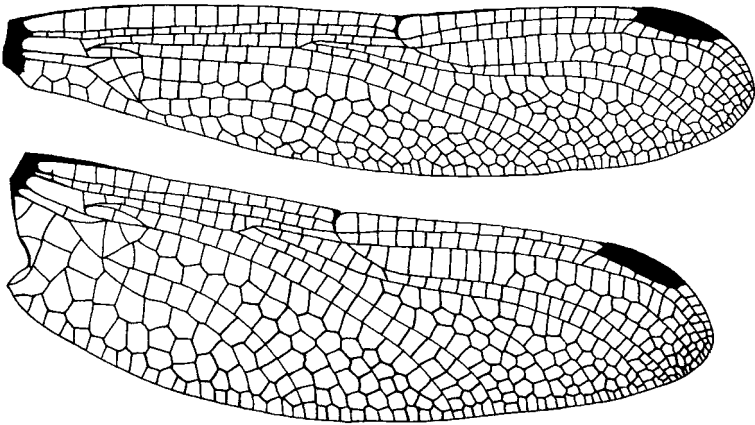


Fig. 3.2.706 The fore and hind wing of a male *Phyllocycla neotropica*. Based on Belle (1970a).

6. On the inner side of each superior anal appendage of the male, there is a tiny process curved inward. The apex of the posterior genital hamule forms a conical process barely half as long as the globular basal portion (**Fig. 3.2.705**).*Phyllocycla armata* Belle, 1977 (Pará).

- On the inner side of each superior anal appendage of the male, there is a robust hook-like process directed more posteriad than inward almost as far as the hooked apex, which curves rather sharply inward. The apex of the posterior genital hamule forms a finger-like process at least $\frac{3}{4}$ as long as the globular basal portion (Fig. 3.2.707).

.....*Phyllocycla hamata* Belle, 1990
(Rondônia).

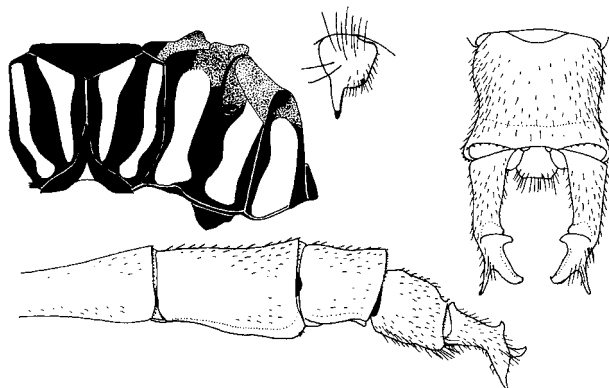


Fig. 3.2.707 *Phyllocycla hamata* male: diagram of the color pattern on the synthorax (upper left), posterior genital hamule in ventral view (upper center), apical segments of the abdomen in lateral view (below), and the tenth abdominal segment with appendages in dorsal view (upper right). Based on Belle (1990).

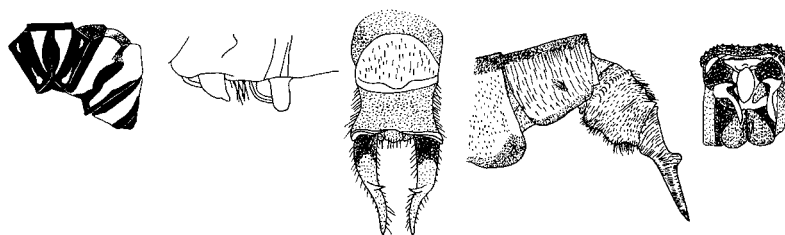


Fig. 3.2.708 *Phyllocycla titschacki* male (left to right): diagram of the thoracic color pattern where the dark color is black and the light color, green; genitalia on the second abdominal segment in lateral view; apex of the abdomen in dorsal, lateral, and posterior view. Based on Schmidt (1942a).

7. The lengths of the tenth abdominal tergite and the superior appendage are about equal. The apex of the superior appendage bends ventrad at an oblique angle (Fig. 3.2.706).

.....*Phyllocycla neotropica* Belle, 1970
(French Guiana, Surinam).

- The length of the superior appendage is about 1.5 times the length of the tenth abdominal tergite. The apex of the superior appendage is very long and pointed (**Fig. 3.2.708**). Length of male abdomen: 38 mm. Length of hind wing of male: 28 mm. Length of the pterostigma of the male hind wing: 3 mm. Coloration: mainly black and green with dark red femora.

.....*Phyllocycla titschacki* (Schmidt, 1942)
(Peru, Bolivia). Syn: *Gomphoides titschacki* Schmidt, 1942; *Negomphoides titschacki* Schmidt, 1952.

8. The tenth abdominal sternite has distinct tufts of brownish yellow setae at the apical corners (**Fig. 3.2.703**). 9

- The tenth abdominal sternite does not have distinct tufts of brownish yellow setae at the apical corners (**Fig. 3.2.709**). 11

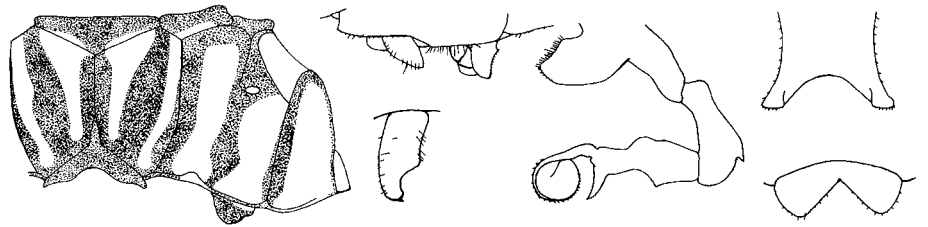


Fig. 3.2.709 *Phyllocycla hespera* (left to right): diagram of the color pattern on the synthorax of a male, male genitalia on the second abdominal segment in lateral view (above) and the right posterior hamule in ventral view (below), penis in lateral view, tenth sternite of the male in ventral view (above), and the vulvar lamina of a female in ventral view (below). Based on Belle (1988a).

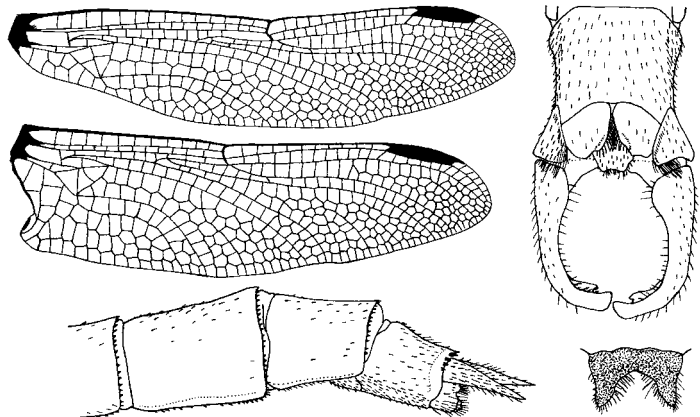


Fig. 3.2.710 *Phyllocycla viridipleuris*: fore and hind wing (upper left), apex of the male abdomen in dorsal view (upper right), apex of the female abdomen in lateral view (lower left), and vulvar lamina (lower right). Based on Belle (1972a).

9. There is only the faint suggestion of a color pattern on the thorax, and a second pair of pale antehumeral stripes is absent. The superior anal appendages are evenly curved and converge at the midline (**Fig. 3.2.703**).

.....*Phyllocycla pallida* Belle, 1970
(Uruguay, Santa Catarina).

- There is a distinct color pattern on the dorsal surface of the pterothorax, and a second pair of pale antehumeral stripes is present (**Fig. 3.2.710**). 10

10. There are lateral dilations on the eighth abdominal segment, which are entirely yellow (**Fig. 3.2.710**).

.....*Phyllocycla viridipleuris* (Calvert, 1909)
(Argentina, Paraguay, Rio Grande do Sul, Santa Catarina, Rio de Janeiro, São Paulo). Syn: *Gomphoides viridipleuris* Calvert, 1909; *Aphylla viridipleuris* (Calvert, 1909).

- The lateral dilations on the eighth abdominal segment are mainly or entirely black (**Fig. 3.2.711**).

.....*Phyllocycla propinqua* Belle, 1972
(Argentina, Uruguay, Paraguay, Santa Catarina).

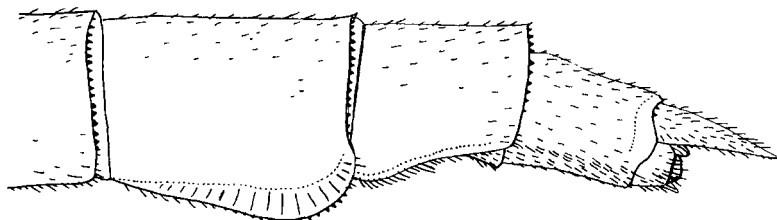


Fig. 3.2.711 Apical segments of the abdomen of a female *Phyllocycla propinqua* in lateral view. Based on Belle (1972a).

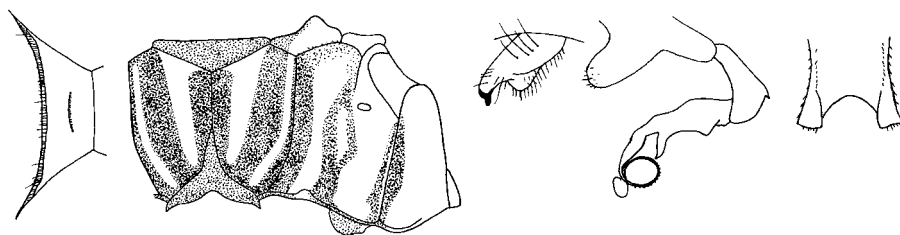


Fig. 3.2.712 *Phyllocycla malkini* male (left to right): occipital plate in dorsal view, diagram of the color pattern on the thorax, ventral view of the right posterior hamule, penis in lateral view, and the tenth abdominal sternite in ventral view. Based on Belle (1988a).

11. There is no protuberance near the base of the superior appendage. The margin of the lateral dilations on the eighth abdominal segment is somewhat concave at its midlength, and there is a row or denticles along its inner margin.

There is a narrow, yellow mid-dorsal stripe on the eighth and ninth abdominal tergites. The sides of the emargination of the vulvar lamina meet at an angle of about 90° (**Fig. 3.2.709**). Length of female abdomen: c. 40 mm including appendages. Hind wing length: c. 31 mm. Length of the pterostigma in the forewing: c. 3.8 mm.

.....*Phyllocycla hespera* (Calvert, 1909)
(Ecuador). Syn: *Gomphoides hesperus* Calvert, 1909; *Aphylla hespera* (Calvert, 1909).

- There is a protuberance near the base of the ventral margin of the superior appendage, where the margin curves sharply ventrad. 12
12. The margin of the lateral dilations on the eighth abdominal segment is evenly rounded. The superior appendage narrows sharply posterior to a basal protuberance on its ventral side. The head and ground color of the thorax is brown, and there are diagonal dull green lateral stripes on the thorax (**Fig. 3.2.712**). The abdomen is mainly black with a bright red marking on the ventral surfaces of the eighth and ninth segments, brighter in the male than in the female. There are also yellowish markings on the anterior parts of the first through seventh abdominal segments, which may be obliterated in the male.

.....*Phyllocycla malkini* Belle, 1970
(Ecuador, Peru, Maranhão).

- The margin of the lateral dilations on the eighth abdominal segment is somewhat angular at its midlength. The superior appendage narrows gradually posterior to a basal protuberance on its ventral side.

.....*Phyllocycla basidenta* Dunkle, 1987
(Argentina, Bolivia).

13. There is a sharp, thick, conical tooth on the ventral margin at the base of the superior appendage. The emargination at the apex of the tenth abdominal sternite of the male is broad and shallow (**Fig. 3.2.713**).

.....*Phyllocycla bartica* Calvert, 1948
(Guyana, French Guiana, Pará).

- There is no conical tooth-like structure on the ventral margin of the superior appendage (**Fig. 3.2.702**). 14

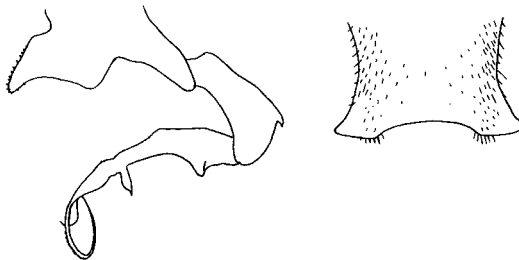


Fig. 3.2.713 *Phyllocycla bartica* male: penis in lateral view (left) and apical portion of the tenth abdominal sternite in ventral view (right). Based on Belle (1988a).

14. There is only a simple carina on the inner margin at the base of the superior appendage. The median emargination of the tenth sternite of the male abdomen is broad and shallow (**Fig. 3.2.714**).

.....*Phyllocycla signata* (Hagen in Selys, 1854)
(Rio de Janeiro). Syn: *Cyclophylla signata* Hagen in Selys, 1854.

- There is a plate-like structure or an additional carina on the inner margin at the base of the superior appendage (**Fig. 3.2.702**).15

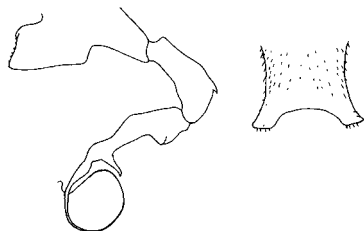


Fig. 3.2.714 *Phyllocycla signata* male: penis in lateral view (left) and the apical portion of the tenth sternite in ventral view (right). Based on Belle (1988a).

15. There is a tubercle or tooth near the mid-length of the superior appendage, near the dorsal margin of the inner side (**Fig. 3.2.702**).16

- There is no tubercle or tooth on the inner side of the superior appendage (**Fig. 3.2.715**).17

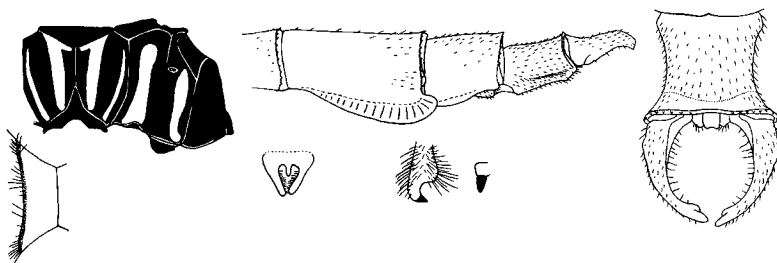


Fig. 3.2.715 *Phyllocycla baria* male (above, left to right): diagram of the color pattern on the synthorax, where the dark color is dark brown, and the light color, green; apical segments of the abdomen in lateral view; apex of the abdomen in dorsal view; and (below, left to right): occipital plate; vesicle in posterior view; posterior hamule in ventral and oblique lateral view. Based on Belle (1987c).

16. The lateral dilations on the eighth abdominal segment are widest at mid-length and relatively broad (**Fig. 3.2.584**). There is a distinct color pattern on most of the thorax.

.....*Phyllocycla medusa* Belle, 1988
(Pará).

- The proximal 2/3 of the lateral dilations on the eighth abdominal segment is relatively narrow (**Fig. 3.2.702**). Only the synthorax has a distinct color pattern.

.....*Phyllocycla pegasus* (Selys, 1869)
(Pará, Amazonas, Goiás, Mato Grosso). Syn: *Cyclophylla pegasus* Selys, 1869.

17. There is only a simple carina on the dorsal margin of the superior appendage (**Fig. 3.2.715**). 18

- There is a tooth or strong angulation on the upper margin of the superior appendage located between the base and the point at which the appendage bends inward and ventrad (**Fig. 3.2.716**). 20

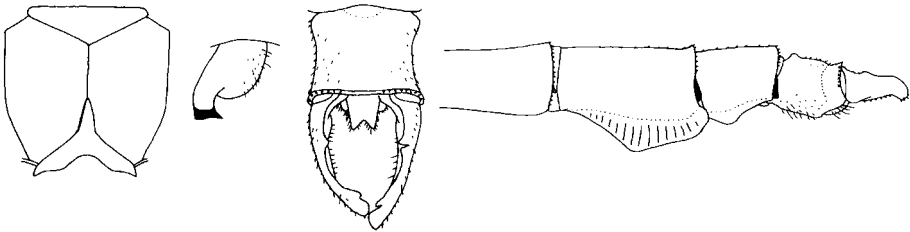


Fig. 3.2.716 *Phyllocycla murrea* male (left to right): dorsal color pattern on the thorax, right posterior hamule in ventral view, apex of the abdomen presumed to be of this species in dorsal view, and apical abdominal segments in lateral view. Based on Belle (1998), including an incorrectly numbered figure.

18. The lateral dilations on the eighth abdominal segment are widest at the apex of the segment (**Fig. 3.2.715**). Total length of male: c. 45 mm. Length of male abdomen including the 1.5 mm anal appendages: c. 35 mm. Hind wing length of male: 27 mm. Length of pterostigma of the fore-wing along the costal margin: c. 3.1 mm. Coloration: predominantly dark brown with greenish markings with a blackish abdomen with brownish yellow markings on the seventh through tenth segments. The wings have brownish membranes, brownish black veins, and brownish yellow pterostigmas. The female has not been described.

.....*Phyllocycla baria* Belle, 1987
(Venezuela).

- At about mid-length of the segment, the lateral dilations on the eighth abdominal segment are widest (**Fig. 3.2.717**). 19

19. In lateral view, the superior appendage appears thick with a broad apex and a prominent blunt dorsal corner. The sides of the median emargination at the apex of the tenth abdominal sternite of the male form an angle of slightly greater than 90°. The preapical segment of the penis is less than twice as long as its maximum width (**Fig. 3.2.717**).

.....*Phyllocycla ophis* (Selys, 1869)
(Venezuela, Guyana, French Guiana, Surinam, Amazonas, Pará). Syn: *Cyclophylla ophis* Selys, 1869; *Cyclophylla pachystyla* Needham, 1944.

- In lateral view, the superior appendage appears to taper to a narrow apex. The penis has a truncate process at the base. The preapical segment of the penis is more than twice as long as its maximum width (**Fig. 3.2.718**).

.....*Phyllocycla modesta* Belle, 1970
(Venezuela, Guyana, French Guiana, Surinam, Pará). The considerable similarity between the two species in this couplet places the validity of this species in question.

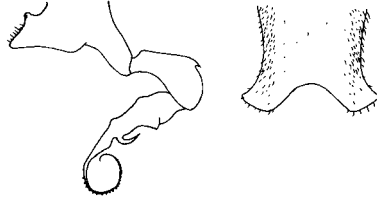


Fig. 3.2.717 *Phyllocycla ophis* male: penis in lateral view (left) and apical portion of the tenth abdominal sternite in ventral view (right). Based on Belle (1988a).

20. The blackened apex of the posterior hamule, in ventral view, is truncate and appears somewhat pointed on each side (**Fig. 3.2.716**).21

- The blackened apex of the posterior hamule, in ventral view, is blunt or pointed but not truncate (**Fig. 3.2.719**).24



Fig. 3.2.718 Penis of *Phyllocycla modesta* in lateral view. Based on Belle (1988a).

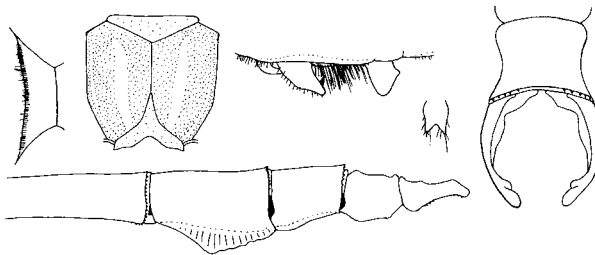


Fig. 3.2.719 *Phyllocycla sordida* male (above, left to right): occipital plate in dorsal view, dorsal color pattern on the synthorax, genitalia on the second abdominal segment in lateral view, inferior anal appendage in dorsal view, apex of the abdomen in dorsal view, and (below left) the apex of the abdomen in lateral view. Based on Belle (1988a).

21. The pale mesothoracic “half-collar” is not connected to the first humeral stripe, which is narrow and parallel sided (**Fig. 3.2.716**).

..... *Phyllocycla murrea* Belle, 1988
(Sergipe).

- The pale mesothoracic “half-collar” is confluent with the first humeral stripe, which widens anteriorly (**Fig. 3.2.720**).22

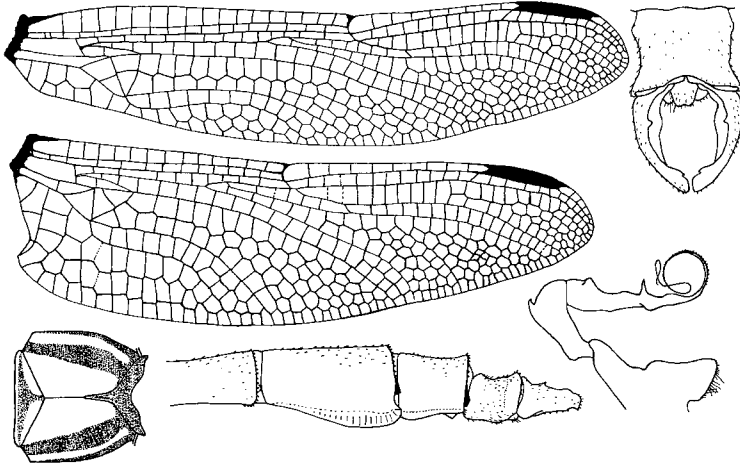


Fig. 3.2.720 *Phyllocycla brasilia*: fore and hind wing of a male (above left), dorsal view of the thorax showing the color pattern of a male (lower left), apical segments of the male abdomen in lateral view (lower center), dorsal view of the apex of the male abdomen with caudal appendages (upper right), and penis in lateral view (lower right). Based on Belle (1988a).

22. The widest part of the lateral dilations on the eighth abdominal segment is on the apical half of the segment, where the width remains almost equal (**Fig. 3.2.720**).

..... *Phyllocycla brasilia* Belle, 1988
(Sergipe).

- The widest part of the lateral dilations on the broad, leaf-like eighth abdominal segment is near mid-length (**Fig. 3.2.721**).23

23. The lateral dilations on the ninth abdominal segment are not wider than about 1/3 of the width of those on the eighth segment. There are two distinct points on the truncate apex of the posterior hamule, an anterior and a posterior (**Fig. 3.2.721**). Hind wing length: c. 30 mm. Length of pterostigma of fore-wing: c. 4.5 mm.

..... *Phyllocycla argentina* (Hagen in Selys, 1878)
(Argentina, Uruguay, Minas Gerais). Syn: *Cyclophylla argentina* Hagen in Selys, 1878; *Gomphoides eugeniae* Navás, 1927.

- The lateral dilations on the ninth abdominal segment are about 1/2 of the width of those on the eighth segment. An anterior point is absent on the truncate apex of the posterior hamule (**Fig. 3.2.722**).

.....*Phyllocycla foliata* Belle, 1988
(Argentina).

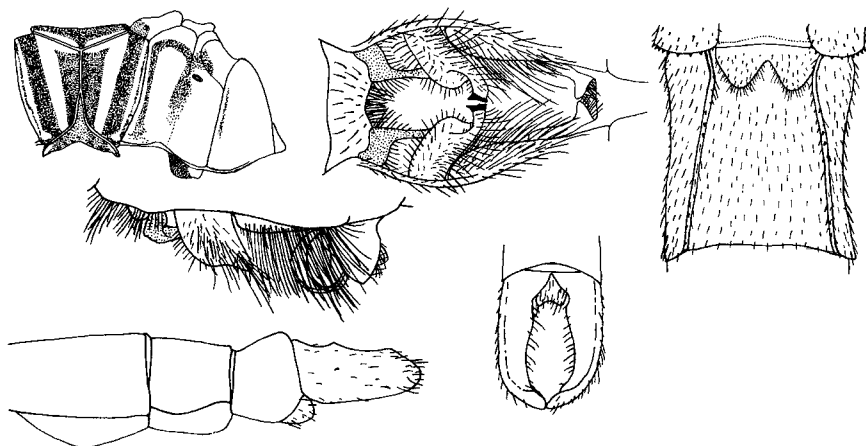


Fig. 3.2.721 *Phyllocycla argentina*: diagram of the color pattern on the pterothorax of a male (upper left), genitalia on the second abdominal segment of a male in ventral (upper center) and lateral view (middle left), ninth segment of the female abdomen showing the vulvar scale (upper right), and the apex of the abdomen of a male in lateral view (lower left), and the anal appendages in dorsal view (lower right center). Based on Belle (1970a).

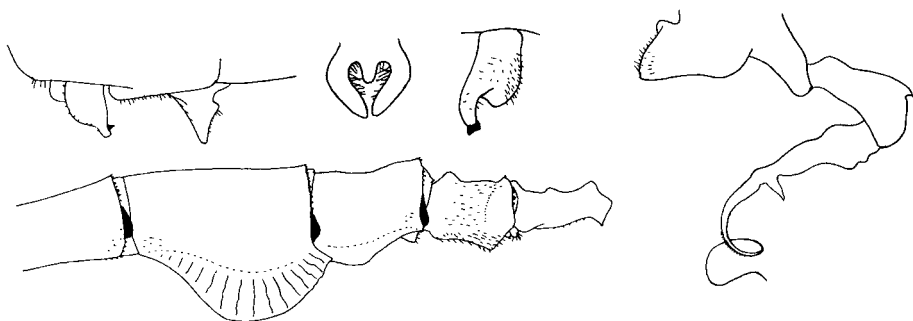


Fig. 3.2.722 *Phyllocycla foliata* male (above, left to right): genitalia on the second abdominal segment in lateral view, seminal vesicle in dorsal view, ventral view of the right posterior hamule, penis, and (below left) the apex of the abdomen in lateral view. Based on Belle (1988a).

24. The free border of each lateral dilation on the eighth abdominal segment is straight, and the anterior and posterior borders meet at mid-length, the widest part, at an angle of about 120° (**Fig. 3.2.719**).

.....*Phyllocycla sordida* (Selys, 1854)
(Venezuela, Pará). Syn: *Cyclophylla sordida* Selys, 1854.

- The lateral dilations on the eighth abdominal segment are broadly rounded and leaf-like (**Fig. 3.2.723**).25

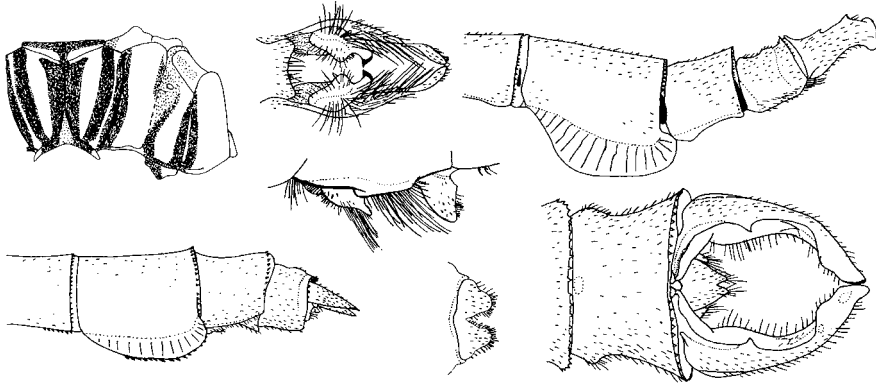


Fig. 3.2.723 *Phyllocycla vesta*: diagram of the color pattern on the synthorax of a male (upper left), male genital organs on the second abdominal segment in ventral and lateral view (upper center, above and below, respectively), apex of the male abdomen in dorsal (lower right) and lateral view (upper right), apex of the female abdomen in lateral view (lower left), and the vulvar lamina (lower center). Based on Belle (1972a).

25. The superior appendage has a tooth on the carinate upper edge about 1/3 of the length from the base. The inferior appendage has a V-shaped incision at the apex (**Fig. 3.2.723**).

.....*Phyllocycla vesta* Belle, 1972
(Argentina).

- The superior appendage has a tooth on the carinate upper edge about 2/7 of the length from the base. The inferior appendage is only slightly concave on the posterior margin (**Fig. 3.2.724**).26

26. The labrum is brown at the base and has a yellow free margin. The widest point of the lateral dilation on the eighth abdominal segment is at the mid-length (**Fig. 3.2.724**).

.....*Phyllocycla gladiata* (Hagen in Selys, 1854)
(Pernambuco).

- The labrum is entirely yellow. The widest point of the lateral dilation on the eighth abdominal segment is slightly beyond the mid-length of the segment (**Fig. 3.2.725**). The wing venation is rather yellowish, especially near the arculus and

the fused portion of veins A_1 and CU_2 of the hind wing. The anterior margin of the costa is strongly yellow from the base to the pterostigma. The tibiae are yellow ventrally. The anteroventral edge of the hind femur is armed with about 9 short spines on the basal third and about 7 spines on the distal two thirds. Length of abdomen of male: 42 mm; hind wing of male: 34 mm; pterostigma length: 4.5 mm.

.....*Phyllocycla diphylla* (Selys, 1854)
(Venezuela, Argentina, Amazonas, São Paulo). Syn: *Cyclophylla diphylla* Selys, 1854.

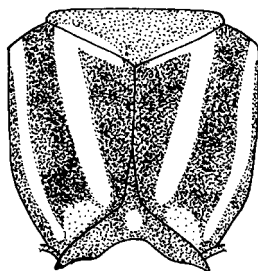


Fig. 3.2.724 The dorsal color pattern on the synthorax of *Phyllocycla gladiata*. Based on Belle (1988a).

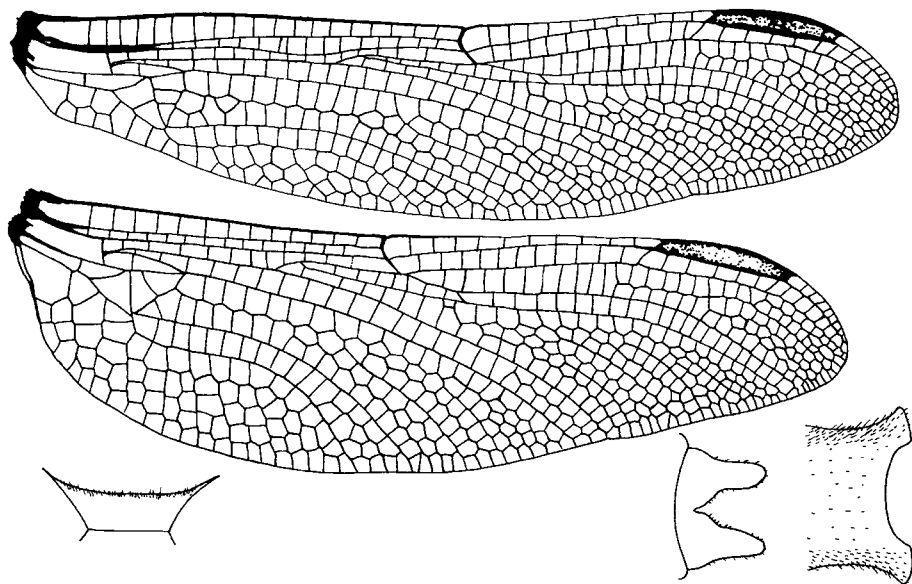


Fig. 3.2.725 *Phyllocycla diphylla*: fore and hind wing of a female (above), occipital plate of a female (lower left), vulvar lamina in ventral view (lower right center), and apical sternite of a male (lower right). Based on Belle (1988a).

Key to the species of known *Phyllocycla* larvae in South America

Information for the key was provided by Belle (1970a) and Rodrigues Capitulo (1983). The key is limited to only four known species.

1. The breathing tube at the apex of the abdomen is not longer than the combined length of the eighth, ninth, and tenth abdominal segments (**Fig. 3.2.726**). 2
- The breathing tube at the apex of the abdomen is about as long as the fifth through tenth abdominal segments combined (**Fig. 3.2.727**). 3

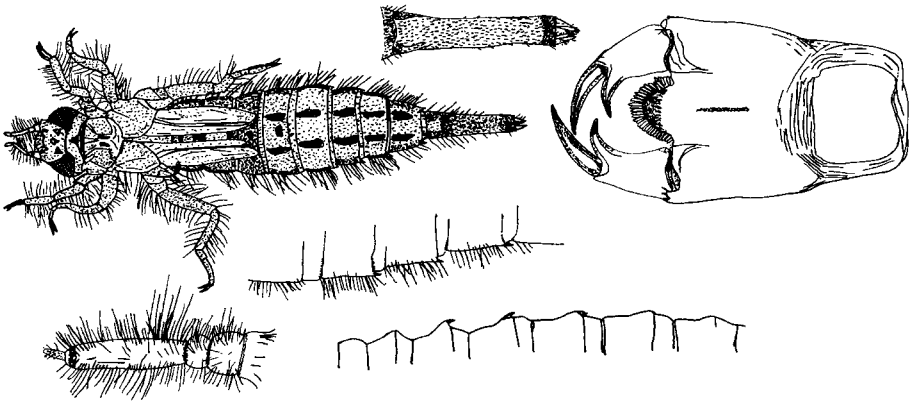


Fig. 3.2.726 *Phyllocycla argentina* larva: habitus (upper left), antenna (lower left), head in ventral view (upper right), lateral profile of the left side of the abdomen to show the short lateral spines (center), dorsal profile of abdomen showing the dorsal spines (lower right), and the caudal appendages modified into a breathing tube (upper center). Based on Rodrigues Capitulo (1983).

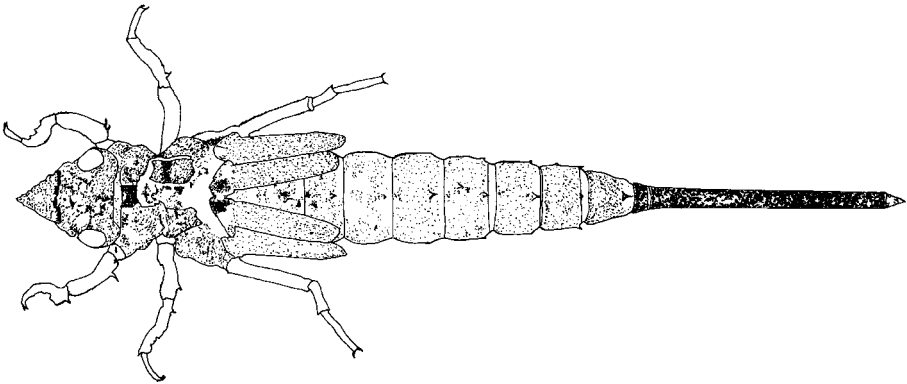


Fig. 3.2.727 *Phyllocycla ophis* habitus from an exuvia. Based on Belle (1970a).

2. The length of the abdomen, including the apical breathing tube, is between four and five times its maximum width, which is located at its fifth and sixth segments. The color pattern consists of well-defined elongate dark markings paired on either side of the midline and median dark markings on the anterior segments. The larva has a dense coat of setae (**Fig. 3.2.726**).

.....*Phyllocycla argentina* (Hagen in Selys, 1878) (Argentina, Uruguay, Minas Gerais). Syn: *Cyclophylla argentina* Hagen in Selys, 1878; *Gomphoides eugeniae* Navás, 1927.

- The length of the abdomen, including the apical breathing tube, is about six times its maximum width, which is located at its anterior three segments. The color pattern consists of diffuse dark markings (**Fig. 3.2.599**).

.....*Phyllocycla viridipleuris* (Calvert, 1909) (Argentina, Paraguay, Rio Grande do Sul, Santa Catarina, Rio de Janeiro, São Paulo). Syn: *Gomphoides viridipleuris* Calvert, 1909; *Aphylla viridipleuris* (Calvert, 1909).

3. The abdomen is almost entirely a uniform pale color, and its segments bears small middorsal spines. The wing cases are slightly divergent (**Fig. 3.2.727**).

- The abdomen has a pattern of dark dorsolateral spots divided by a median pale stripe and pale margins between the middle and apical segments. The wing cases are nearly parallel (**Fig. 3.2.728**)

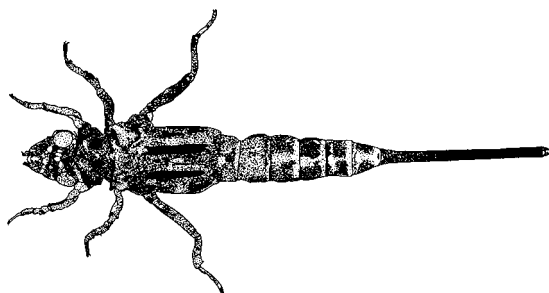


Fig. 3.2.728 *Phyllocycla modesta* habitus from an exuvia. Based on Belle (1970a).

Key to the species of adult male *Peruviogomphus* in South America

Information for the key was provided by Belle (1979b) and Machado (2005b). Sufficient information on the larvae to prepare a key is not yet available.

1. The lateral extensions on the eighth abdominal segment are narrow and not produced posteriad. The inferior anal appendage reaches almost to the ventrolateral process on the superior appendage. There are three postanal cells, three cells in the triangle, and three rows of cells in the anal area of the hind wing (**Fig. 3.2.729**). Length of male abdomen, including appendages: c. 33 mm.

Hind wing length of male: c. 24.5 mm. Length of the pterostigma on the fore-wing measured along the costal margin: c. 2.3 mm. Color: head mainly green with some yellow on the labium; thorax mainly green with a black middorsal stripe, one pale dorsal stripe, black antehumeral stripes, and black narrowly lining the humeral suture; legs yellow with brown streaks; wings hyaline.

..... *Peruviogomphus moyobambus* Klots, 1944 (Peru).

- On the eighth abdominal segment, there are wide foliate processes that extend posteriad well beyond the posterior margin of the segment. Narrow margins are present on the ninth segment (**Fig. 3.2.730**). 2

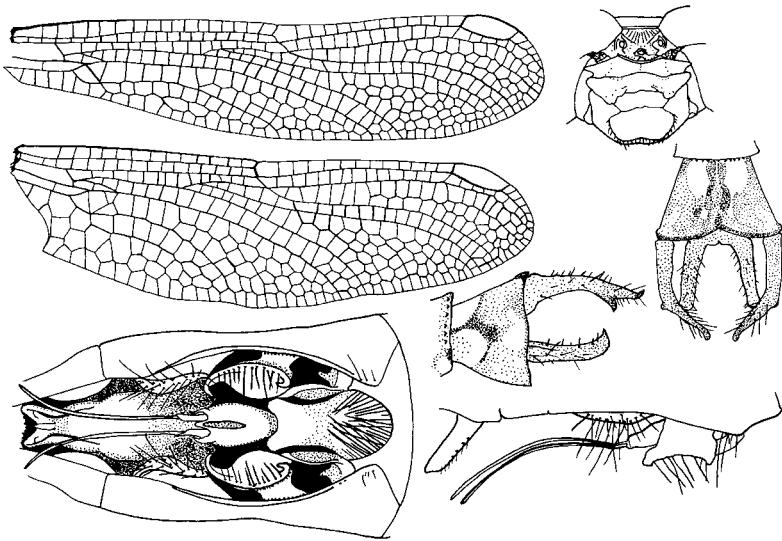


Fig. 3.2.729 *Peruviogomphus moyobambus* male: fore and hind wing (upper left), face in anterior view (upper right), genitalia on the second abdominal segment in ventral (lower left) and lateral view (lower right), and the apex of the abdomen in dorsal (middle right) and lateral view (right center). Based on Klots (1944).

2. The inferior anal appendage is short and does not come close to reaching the ventrolateral process on the superior appendage. The apex of the superior anal appendage is truncate and curved to point at the midline. There are three postanal cells, three cells in the triangle, and three rows of cells in the anal area of the hind wing (**Fig. 3.2.583**). The inner margin of the hind wing lacks denticles. Total length of male: c. 46 mm. Length of male abdomen: c. 36 mm. Hind wing length of male: c. 28 mm. Length of the pterostigma on the fore-wing measured along the costal margin: c. 3.0 mm. Color: head mainly green and yellow with brown on the posterior part; thorax dark brown with green markings

and a pale dorsal stripe on the synthorax; wings hyaline with dark brown veins; abdomen mainly dark brown with yellow markings, including a middorsal stripe on the third through seventh segments and lateral stripes on the second and third segments; there are also brownish yellow lateral markings on the eighth and ninth segments. The female has not been positively identified or adequately described.

.....*Peruviogomphus pearsoni* Belle, 1979
(Ecuador).

- The apex of the inferior anal appendage extends beyond the ventrolateral process on the superior appendage and is visible in dorsal view. The apex of the superior anal appendage is drawn out into a long, narrow process that curves dorsad. There are two postanal cells, four cells in the triangle, and two rows of cells in the anal area of the hind wing. The inner margin of the hind wing has a row of denticles in the middle (**Fig. 3.2.730**). Length of abdomen: c. 31 to 32 mm. Hind wing length: c. 25 to 26 mm. Color: head olive with brown on posterior part; thorax olive brown with two pale dorsal stripes on the synthorax and other pale and dark areas; wings hyaline with black veins and a yellowish brown pterostigma; dark brown dorsally and yellowish laterally on the first two segments followed by four segments brown laterally and darker dorsally with yellow markings, including a narrow middorsal line. The seventh through tenth abdominal segments are reddish brown, and the appendages are dark brown. The female has not been described.

.....*Peruviogomphus bellei* Machado, 2005
(Amazonas).

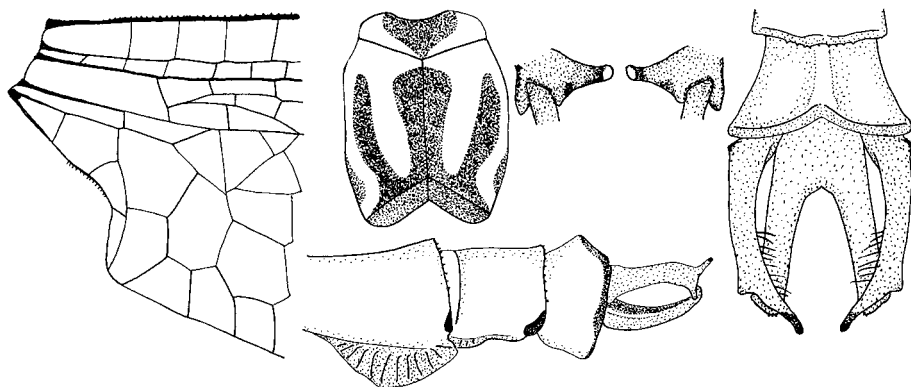


Fig. 3.2.730 *Peruviogomphus bellei* male: base of the hind wing showing the denticulations on the inner margin (left), color pattern on the thorax in dorsal view (upper left center), distal ends of the anal appendages in posterior view (upper right center), and the apex of the abdomen in dorsal (right) and lateral view (lower center). Based on Machado (2005b).

Key to the adults in the genus *Gomphoides* in South America

Information for the key was provided by Förster (1914), St. Quentin (1967) and Belle (1975a). Most species formerly assigned to this genus have been transferred to other genera, and it remains to be seen whether this genus will continue to be recognized as valid.

1. The hind wing is at least 38 mm long. The pterostigma or the fore-wing is yellowish brown. There is a dark median fleck on the whitish labrum (**Fig. 3.2.731**). Length of abdomen: 42 mm. Length of hind wing: 38 mm.

.....*Gomphoides praevius* St. Quentin, 1967 (Argentina, Santa Catarina).

- The hind wing is about 35 mm long. The superior appendices are bright yellow and shorter than the tenth segment (**Fig. 3.2.585**). The inferior appendices are black.2

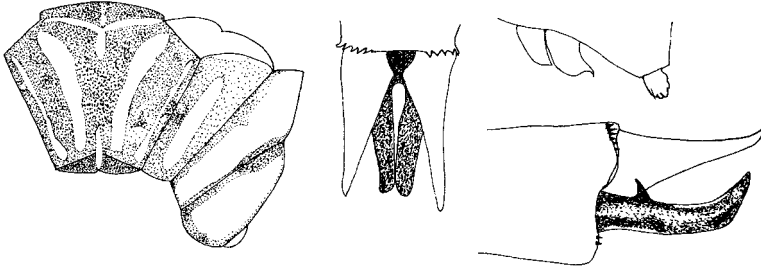


Fig. 3.2.731 *Gomphoides praevius* male (left to right): diagram of the color pattern on the thorax, anal appendages in dorsal view, the genitalia on the second abdominal segment in lateral view (above), and the caudal appendages in lateral view (below). Based on St. Quentin (1967).

2. The inferior anal appendage is about half the length of the superior appendices (**Fig. 3.2.585**). Vein M_3 is straight at its midlength. Length of abdomen: c. 44 mm.

.....*Gomphoides infumatus* (Rambur, 1842) (Rio de Janeiro and other, unspecified locations in Brazil). The species is not well described, and parts of the types are missing.

- The inferior anal appendage is about 4/5 as long as the superior appendices. Vein M_3 is slightly curved so that its side facing the posterior margin of the wing is slightly convex at midlength. Total length: c. 65 mm. Length of abdomen: 43.5 to 46 mm. Hind wing length: c. 43 mm. Length of pterostigma of fore-wing: c. 6 mm. The thorax is bright yellow with reddish brown markings (**Fig. 3.2.732**).

.....*Gomphoides perditus* (Förster, 1914) (Paraguay). Syn: *Ammogomphus perditus* Förster, 1914.

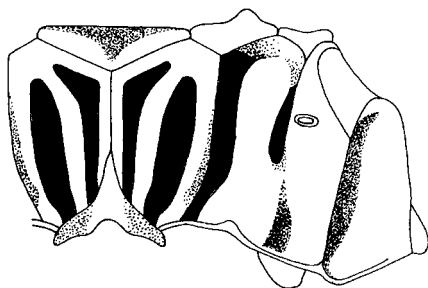


Fig. 3.2.732 Diagram of the color pattern on the thorax of a female *Gomphoides perditus*. Based on Belle (1995a).

Key to the adults of the genus *Idiogomphoides* in South America

Information for the key was provided by St. Quentin (1967) and Belle (1984c, 1995a).

1. The posterior part of the occiput is strongly arched, and its posterior border undulates. There is a deep yellow band on each wing. The pterostigma is yellow and 4 to 5 mm long. In lateral view, the apex of the superior appendage of the male is bent sharply about 90° from the axis of the base (**Fig. 3.2.733**). Length of abdomen: 52 to 53 mm. Hind wing length: 45 to 46 mm.

.....*Idiogomphoides demoulini* (St. Quentin, 1967) (Santa Catarina). Syn: *Gomphoides demoulini* Selys, 1878.

- The occiput is not arched, and its posterior border is straight (**Fig. 3.2.586**). The wings are not yellow banded. 2



Fig. 3.2.733 *Idiogomphoides demoulini* (left to right): genitalia on the second abdominal appendage of the male in lateral view, superior appendage of the male in dorsal and lateral view, and the vulvar lamina of a female in ventral view. Based on St. Quentin (1967).

2. The middle lobe of the labium is longer along its midline than its greatest width. The costal vein is yellow, and the other veins are black. The pterostigma is black. There is no dark median fleck on the yellowish green labrum (**Fig. 3.2.586**). Length of abdomen: 43 mm to 48 mm. Length of hind wing: 43 mm.

.....*Idiogomphoides ictinius* (Selys, 1878)
(Pernambuco). Syn: *Gomphoides ictinia* Selys, 1878.

- The middle lobe of the labium is much shorter along its midline than its greatest width (Fig. 3.2.734). Total length: c. 65 mm. Length of abdomen, including appendages: c. 48 mm. Hind wing length: 42 mm. Pterostigma of forewing measured along the costa: 5.8 mm.

.....*Idiogomphoides emmeli* Belle, 1995
(Pará).



Fig. 3.2.734 Outline of the apical portion of the labium of *Idiogomphoides emmeli*. Based on Belle (1995a).

Key to the adults of the genus *Phyllogomphoides* in South America

Information for the key was provided by Needham (1944) and Belle (1982b, 1984d, 1994c).

1. There is a pair of long, horn-like processes rising dorsad from the frons of the female; in frontal view, they extend well above the dorsal surface of the head (**Fig. 3.2.735**). The body is nearly free of hair-like setae. There are no lateral expansions of the eighth and ninth abdominal segments. The head and thorax are mainly dull brown with poorly defined stripes. The abdomen is dull yellow at the base and blackish toward the apex with a well-defined, yellowish basal ring only on the seventh segment. There are yellowish-red ventrolateral markings on the eighth and ninth abdominal segments. The wings are hyaline with blackish veins and a brown stigma. Length of female abdomen: c. 38 mm. Hind wing length of female: c. 33 mm. The male has not been described.

.....*Phyllogomphoides cornutifrons* Needman, 1944
(Trinidad, Venezuela).

- In a frontal view of the head, there are no long, horn-like processes rising from the frons that extend above the dorsal surface of the head.2

2. The anterior hamules are shaped like a conch (**Fig. 3.2.736**). Total length of male: 52 to 53 mm. Hind wing length of male: c. 30 mm. Length of costal border of pterostigma of male: c. 3.5 mm. The female has not been described.

.....*Phyllogomphoides singularis* Belle, 1979
(Bolivia).

- The anterior hamules are not shaped like a conch (**Fig. 3.2.737**).3

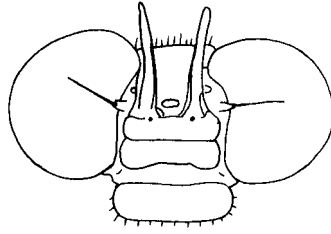


Fig. 3.2.735 The head of a female *Phyllogomphoides cornutifrons* in frontal view. Based on Needham (1944).

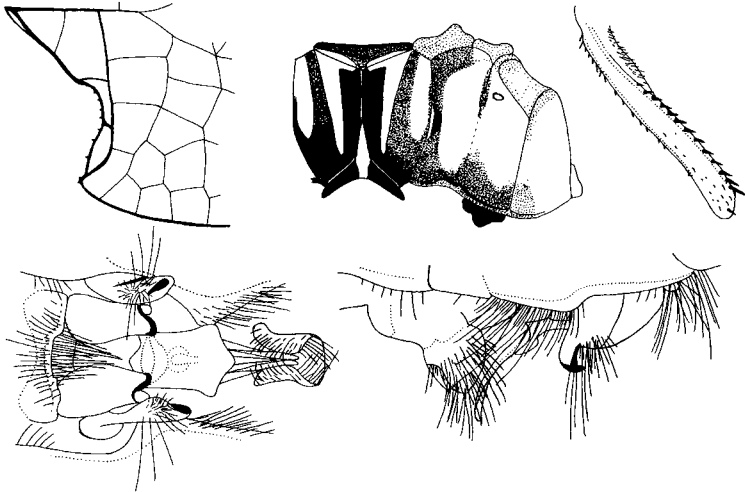


Fig. 3.2.736 *Phyllogomphoides singularis* male (above, left to right): anal area of the hind wing, diagram of the color pattern on the thorax, the apex of hind tibia, and (below) the male sexual organs on the second abdominal segment in ventral (left) and lateral view (right). Based on Belle (1979c).

3. In dorsal view, the superior caudal appendages of the male are each almost straight to near the apex, where they curve slightly toward each other (**Fig. 3.2.737**).4

- In dorsal view, the superior caudal appendages of the male curve strongly toward each other (**Fig. 3.2.738**).7

4. There is no pale dorsal collar on the mesothorax. The second pale antehumeral stripe is not present or is vestigial in the male, and the first antehumeral stripe of the female has an oblong shape somewhat like a pear. The wings of the male are slightly darkened at the apices (**Fig. 3.2.737**).

.....*Phyllogomphoides andromeda* (Selys, 1869)
(Venezuela, French Guiana, Guyana, Surinam, Argentina, Pará, Paraná). Syn:
Cyclophylla andromeda Selys, 1869.

- There is a well-developed pale dorsal collar on the mesothorax. The second pale antehumeral stripe is evident in the male, and the first antehumeral stripe of the female is not oblong or pear-shaped (Fig. 3.2.739). 5

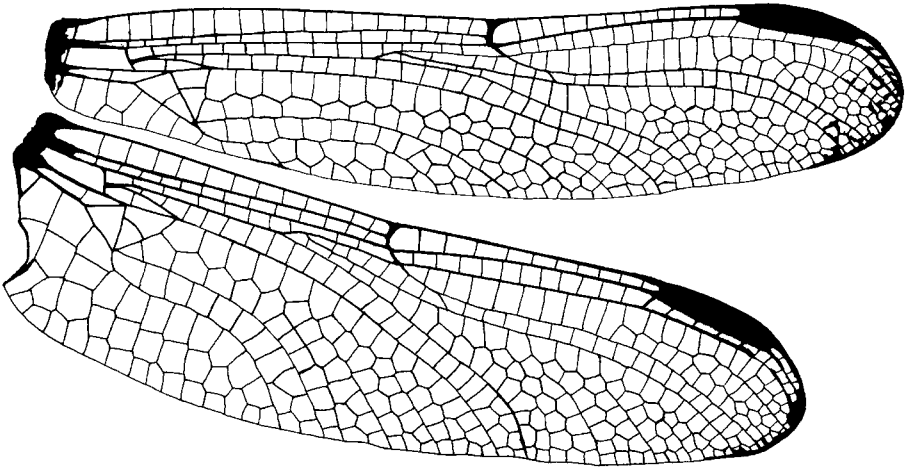


Fig. 3.2.737 Fore and hind wing of a male *Phyllogomphoides andromeda*. Based on Belle (1970a).

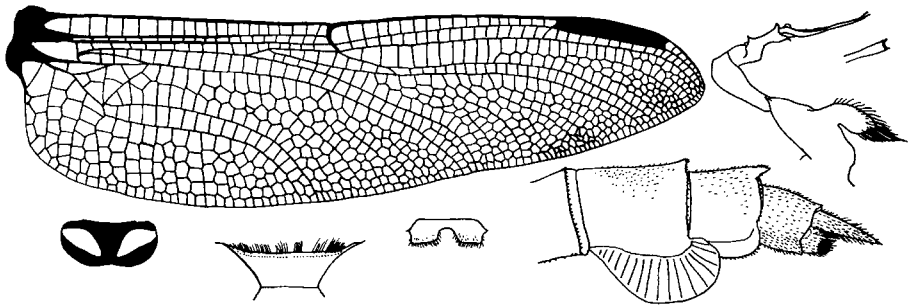


Fig. 3.2.738 *Phyllogomphoides major*: hind wing of a female (upper left), color pattern on the labrum of a female (lower left), occipital plate of a female (lower left center), vulvar lamina in ventral view (lower right center), apex of the abdomen of a female in lateral view (lower right), and penis in lateral view showing an enlargement of its apex (upper right). Based on Belle (1984d).

5. The first and second pale antehumeral stripes of the male broadly join the pale dorsal collar on the mesothorax. The posterior genital hamule is elongate posteriad and reaches to a point well dorsal to the seminal vesicle (**Fig. 3.2.739**). The female has not been described.

.....*Phyllogomphoides joaquinii* Rodrigues Capitulo, 1992 (Argentina).

- The second pale antehumeral stripe of the male is separated from the pale dorsal collar on the mesothorax. The posterior genital hamule reaches a point well anterior to the seminal vesicle (**Fig. 3.2.740**). 6

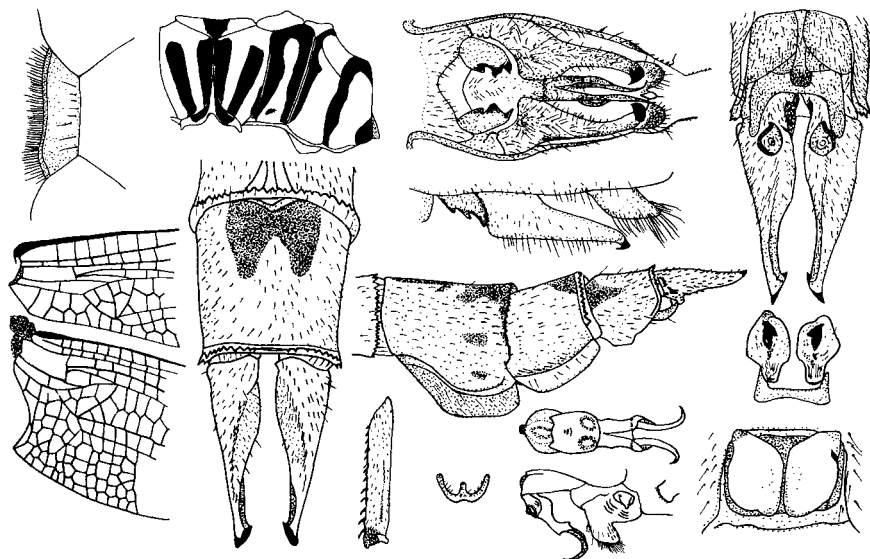


Fig. 3.2.739 *Phyllogomphoides joaquinii* male: dorsal view of the occipital plate (upper left), diagram of the color pattern on the synthorax whereby the dark color is brown and the light color is yellowish green (upper left center), bases of the fore and hind wings (lower left), hind femur in lateral view (below, left of center), genitalia on the second abdominal segment in ventral and lateral view (upper right center, above and below, respectively), penis in ventral and lateral view (lower right center, above and below, respectively), hood of penile peduncle in posterior view (below, right of center), valvules on the ninth abdominal segment (lower right), and the apical segments of the abdomen in dorsal (lower left center), ventral (upper right), lateral (center), and posterior view (middle right). Based on Rodrigues Capitulo (1992).

6. The face of the male is green with a black band along the free margin of the labrum. The eighth abdominal segment of the female has a lateral dilation that is at least 1/4 of the middorsal length of the segment. The labrum of the female is

mainly pale with a black band along its free margin, and a second antehumeral stripe and metepisternal stripes of the female are pale (**Fig. 3.2.740**).

.....*Phyllogomphoides cassiopeia* (Belle, 1975)
(Paraguay). Syn: *Gomphoides cassiopeia* Belle, 1975.

- The face of the male is black except for green markings on the clypeus and labrum. The eighth abdominal segment of the female has a lateral dilation that is no more than about 1/6 of the middorsal length of the segment, but it is twice as wide as the dilation on the ninth segment (**Fig. 3.2.741**). The prothorax is entirely black dorsally.

.....*Phyllogomphoides cepheus* Belle, 1980
(Mato Grosso).

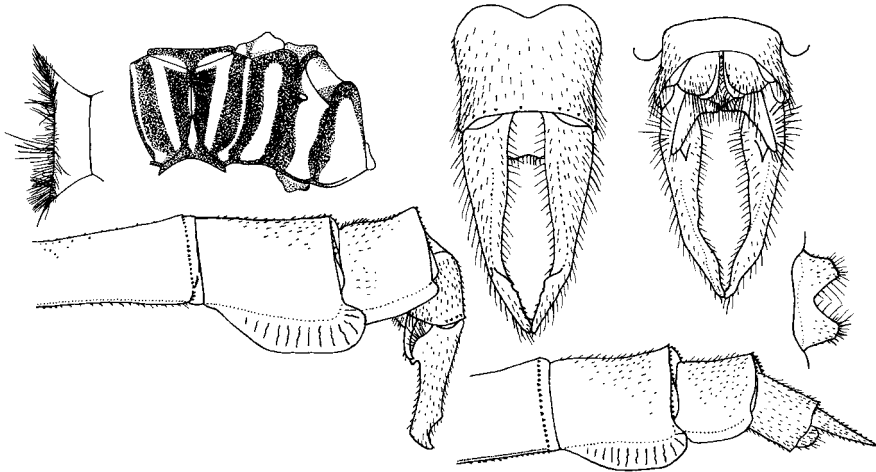


Fig. 3.2.740 *Phyllogomphoides cassiopeia* (above, left to right): occipital plate of a male, diagram of the color pattern on the male synthorax, the apex of the male abdomen in dorsal and ventral view, and (below, left to right): apical segments of the abdomen of a male and a female, and the vulvar lamina, occupying about 1/3 of the length of the ninth abdominal sternite (above apex of female abdomen). Based on Belle (1975a).

7. The anterior hamules of the male have bulbous frontal structures, leaf-like extensions laterally, and an apex that is elongated posteriad. The eighth abdominal segment of the female has a lateral dilation that is at least 1/4 of the middorsal length of the segment (**Fig. 3.2.738**).8

- The anterior hamules of the male are relatively simple in structure. If there are any dilations on the eighth abdominal segment of the female, they do not exceed 1/6 of the middorsal length of the segment, or the labrum has a pair of pale spots and the vulvar lamina has a wide, semi-circular incision and rather narrow, bluntly tipped lobes (**Fig. 3.2.742**). 11

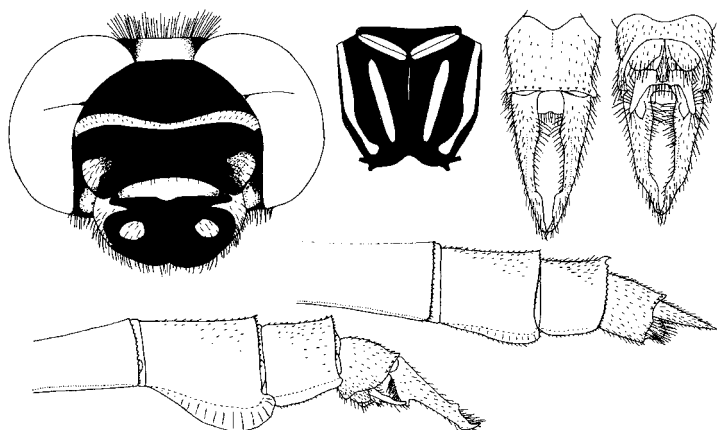


Fig. 3.2.741 *Phyllogomphoides cepheus* (upper row, left to right): head of a male in anterior view, dorsal color pattern on the pterothorax of a male, apex of the abdomen of a male in dorsal and ventral view, and lateral views of the apical segments of the abdomen of a male (lower left) and a female (lower middle right). Based on Belle (1980a).

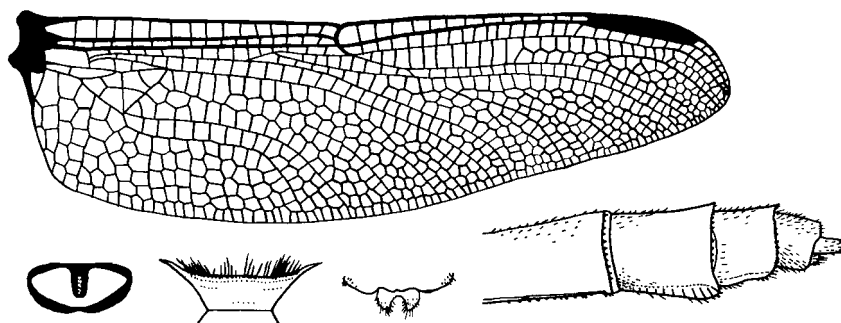


Fig. 3.2.742 *Phyllogomphoides audax* female: hind wing (above) and (lower row, left to right): color pattern on the labrum, occipital plate, vulvar lamina in ventral view, and the apex of the abdomen in lateral view. Based on Belle (1984d).

8. The inferior caudal appendage of the male is much shorter than half as long as the superior appendages and has a deep, V-shaped incision. The labrum of the female has a pair of pale spots, and the pterostigma of the female is 6 to 7 mm long. The second antehumeral stripe and metepisternal stripes of the female are pale. The vulvar lamina is shaped like a U, and each lateral dilation on the eighth abdominal segment of the female is almost half the middorsal length of the segment (**Fig. 3.2.738**). Dimensions of holotype male: total length, about 77

mm; length of abdomen with caudal appendages, 58.5 mm; fore-wing, 45.5 mm; hind wing, 44 mm; costal edge of pterostigma on fore-wing, 6.3 mm,

..... *Phyllogomphoides major* Belle, 1984 (Venezuela, Guyana, French Guiana, Surinam, Pará?).

- The inferior caudal appendage of the male is about half as long as the superior appendages and deeply divided into two branches. The second pale antehumeral and metepisternal stripes of the female are vestigial (**Fig. 3.2.743**), or, if not, the pterostigma of the female is only 5 to 6 mm long. 9

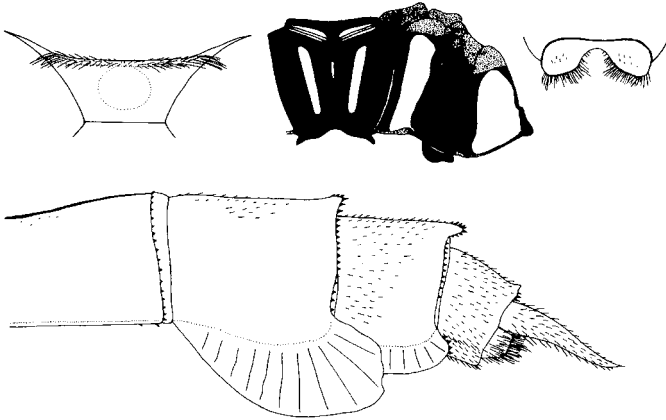


Fig. 3.2.743 *Phyllogomphoides imperator* female: occipital plate (upper left), diagrammatic depiction of the dark brown and yellow color pattern on the pterothorax (upper center), vulvar lamina in ventral view (upper right), and the apex of the abdomen in lateral view (below). Based on Belle (1976a).

9. Pale second antehumeral and metepisternal stripes are absent or vestigial (**Fig. 3.2.743**). Total length: c. 72 mm. Length of abdomen: c. 55 mm. Hind wing length: c. 46 mm. Length of pterostigma in fore-wing: c. 7 mm.

..... *Phyllogomphoides imperator* Belle, 1976 (Venezuela).

- Pale second antehumeral and metepisternal stripes are well developed (**Fig. 3.2.744**). 10

10. The abdomen of the male, including the caudal appendages, is 56 to 57 mm long; that of the female is 55 to 56 mm. That of the female is 55 to 56 mm. The hind wing of the male is about 42 mm, and the costal margin of the pterostigma of the male fore-wing is 5.5 to 5.8 mm. The hind wing of the female is about 43 mm long. The seventh abdominal segment of the male has a pale basal marking covering much more than 1/3 of the segment. There are projecting posterolateral corners on the lobes of the female vulvar lamina (**Fig. 3.2.744**).

..... *Phyllogomphoides selysi* (Navás, 1924) (Peru, Amazonas). Syn: *Gomphoides selysi* Navás, 1924.

- The abdomen of the male is 50 to 54 mm long, and that of the female is 51 to 53 mm, including the cerci. The hind wing of the male is 36 to 37 mm, and that of the female is 37 to 38 mm. The leading edge of the pterostigma of the male is 4.8 to 5.0 mm. The pale marking at the base of the seventh segment of the male abdomen covers about 1/3 of the segment's length. The posterolateral corners of the vulvar lamina are rounded (**Fig. 3.2.745**). Total length: 62 to 69 mm.

..... *Phyllogomphoides fuliginosus* (Hagen in Selys, 1854)
(Guyana, French Guiana, Surinam, Venezuela, Brazil?). Syn: *Gomphoides fuliginosus* Hagen in Selys, 1854.

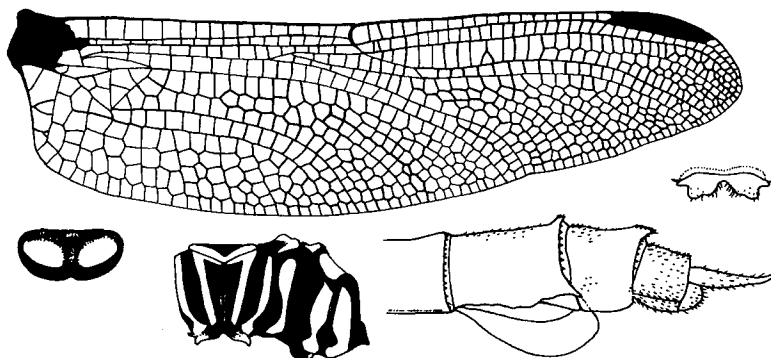


Fig. 3.2.744 *Phyllogomphoides selysi* female: hind wing (upper left), color pattern on the labrum (lower left), lateral color pattern on the thorax (lower center), vulvar lamina in ventral view (middle right), and apex of the abdomen of a female in lateral view (lower right). Based on Belle (1984d).

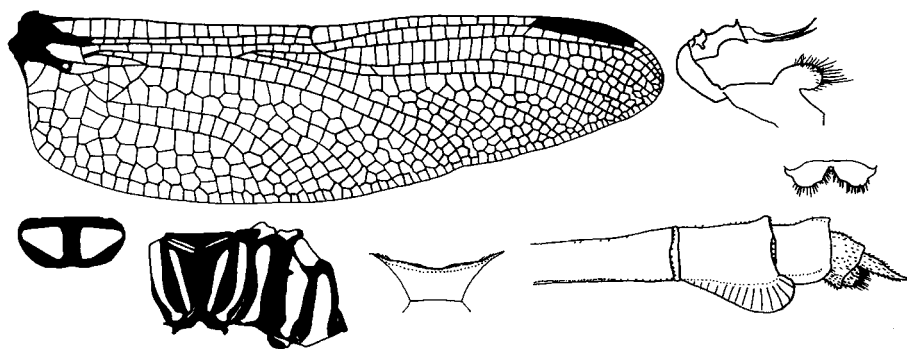


Fig. 3.2.745 *Phyllogomphoides fuliginosus*: hind wing of a female (upper left), color pattern on the labrum of a female (lower left), lateral color pattern on the thorax (lower left center), occipital plate of a female (lower left center), vulvar lamina in ventral view (middle right), apex of the abdomen of a female in lateral view (lower right), and penis in lateral view (upper right). Based on Belle (1984d).

11. The abdomen of the female, including the cerci, is about 50 mm long. The hind wing is about 43 mm long. The vulvar lamina is about 1/3 the width of the ninth sternite (**Fig. 3.2.742**). The male has not been described.

.....*Phyllogomphoides audax* (Selys, 1854)
(Guyana, Surinam, Pará).

- The abdomen of the female, including the cerci, and the hind wing are shorter than 50 mm and 43 mm, respectively. The vulvar lamina is more than 1/3 the width of the ninth sternite (**Fig. 3.2.746**).12

12. There are two ventral processes on the proximal half of each superior caudal appendage of the male (**Fig. 3.2.747**). The female of only one of these species has been described and is characterized by a pair of pale spots on the labrum and a very wide, semi-circular incision in the middle of the vulvar lamina with narrow, bluntly tipped lobes.13

- Either the superior caudal appendages of the male lack ventral processes, or there is only a small basal spine or tooth on the ventral side (**Fig. 3.2.746**).15

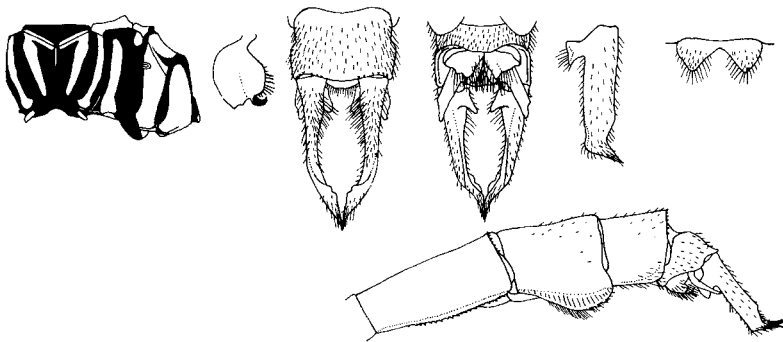


Fig. 3.2.746 *Phyllogomphoides spiniventris* (upper row, left to right): diagram of the color pattern on the synthorax of a male, anterior hamule on the second abdominal segment of a male, apex of the abdomen of a male in dorsal and ventral view, cercus of the male in lateral view, vulvar lamina of a female in ventral view, and (lower right) the apical segments of the male abdomen in lateral view. Based on Belle (1994c).

13. The pale markings on the basal part of the seventh abdominal segment are completely divided by the dark midline into two mid-lateral spots. The eighth abdominal segment of the male has lateral dilations, which are narrow and parallel-sided on the apical half of the segment. The lobes at the apex of the superior anal appendage are directed toward those on the opposite appendage and not recurved posteriad (**Fig. 3.2.748**). Total length of male: c. 53 mm. Male abdomen: c. 43 mm including appendages. Hind wing length of male: c. 39 mm. Pterostigma length in fore-wing: c. 4 mm. The female has not been described.

.....*Phyllogomphoides calverti* (Kirby, 1897)
(Rondônia, Pará). Syn: *Cyclophylla calverti* Kirby, 1897.

- The pale markings on the basal part of the seventh abdominal segment are not divided along the midline and form a single pale patch. The eighth abdominal segment of the male has well developed lateral dilations, which are strongly convex and resemble leaves (Fig. 3.2.747).14

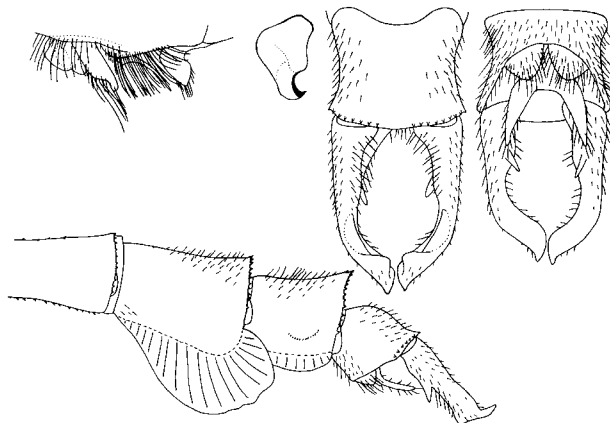


Fig. 3.2.747 *Phyllogomphoides praedatrix* male (above, left to right): genitalia on the second abdominal segment in lateral view, ventral view of the anterior hamule, apex of the abdomen in dorsal and ventral view, and (below) apex of the abdomen in lateral view. Based on Belle (1994c).

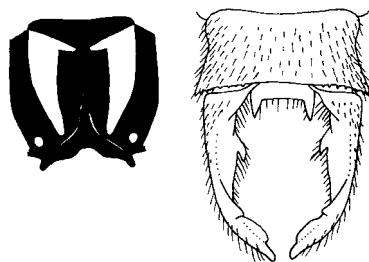


Fig. 3.2.748 *Phyllogomphoides calverti* male: dorsal color pattern on the synthorax (left) and the apex of the abdomen in dorsal view. Based on Belle (1994c).

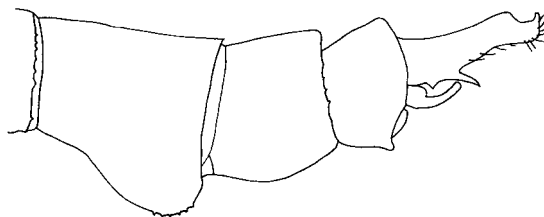


Fig. 3.2.749 Lateral profile of the apical segments of the male abdomen of *Phyllogomphoides camposi*. Based on Calvert (1909b).

14. A second pale antehumeral stripe is absent. The lateral dilations on the eighth abdominal segment of the male extend only to the base of the ninth segment or slightly beyond. There is a tooth or tubercle on the dorsal surface of each superior anal appendage located about 2/3 of the distance from the base (**Fig. 3.2.749**).

.....*Phyllogomphoides camposi* (Calvert, 1909).
(Ecuador). Syn: *Gomphoides camposi* Calvert, 1909.

- The second pale antehumeral stripe is distinct. The posterior part of the lateral dilations on the eighth abdominal segment of the male are widened and cover about 1/4 of the length of the ninth segment. There is a subapical internal lobe on each superior appendage, which points ventrad (**Fig. 3.2.747**). Total length of male: 62 to 63 mm. Length of abdomen: 48 to 50 mm including appendages. Hind wing length: c. 37 mm. Pterostigma length in fore-wing: 4.6 to 5.0 mm.

.....*Phyllogomphoides praedatrix* Belle, 1982
(Rondônia).

15. There is a hatchet-shaped process near the base of each superior anal appendage of the male (**Fig. 3.2.746**). The female has no obvious dilations on the eighth abdominal segment, and the lobes of the vulvar lamina are somewhat triangular and not broadly rounded. The labrum is pale along the free margin, or it is brown, and the vulvar lamina lobes are sharply angled at the apices.16

- There is no hatchet-shaped process near the base of each superior anal appendage of the male (**Fig. 3.2.750**).17

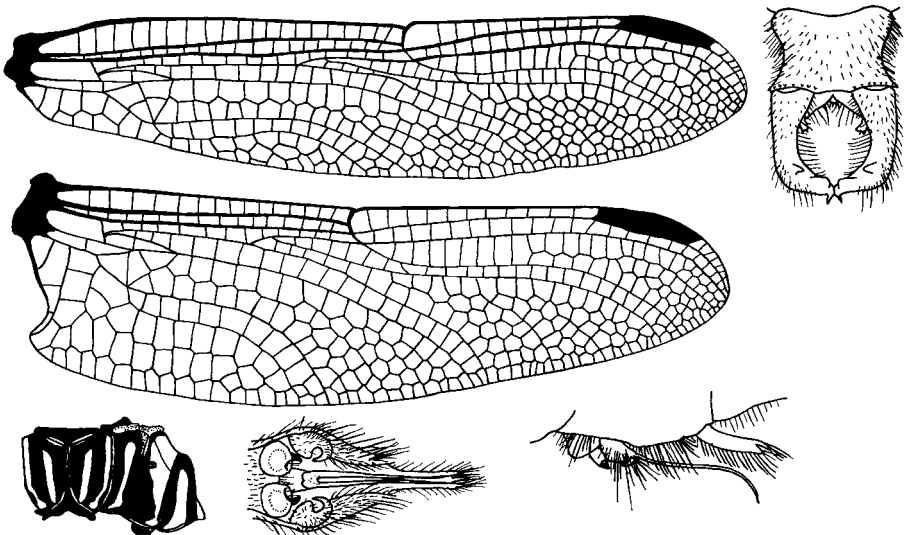


Fig. 3.2.750 *Phyllogomphoides pedunculus* male: fore and hind wing (upper left), dorsal view of the apex of the abdomen (upper right), lateral color pattern on the thorax (lower left), genital structures on the second abdominal segment in ventral (lower center) and lateral view (lower right). Based on Belle (1984d).

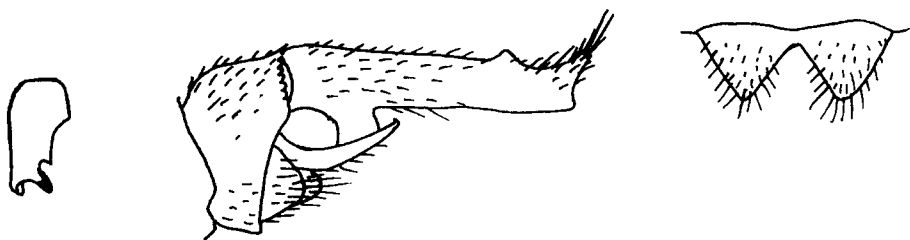


Fig. 3.2.751 *Phyllogomphoides suspectus* (left to right): ventral view of the anterior genital hamule, apex of the male abdomen with appendages in lateral view, view, and the female vulvar lamina in ventral view. Based on Belle (1994c).

16. The hind wing is longer than 32 mm. The ventral margin of the seventh abdominal tergite of the male has a row of strong spines that are mainly yellow on the basal half and black on the apical half. The apex of each superior anal appendage of the male is upright and brown (**Fig. 3.2.746**). The labrum of the female is pale along the free border. Total length: 52 to 55 mm. Length of abdomen, including appendages: 40 to 42 mm. Hind wing length: 33.5 to 35 mm. Length of pterostigma of the fore-wing: 4.6 to 4.8 mm. Color: mainly dark brown with yellow and other pale markings.

.....*Phyllogomphoides spiniventris* Belle, 1994 (Goiás, Mato Grosso).

- The hind wing is shorter than 31 mm. The ventral margin of the seventh abdominal tergite of the male has a row of small spines that are mainly black. The apex of each superior anal appendage of the male is upright and pale. The labrum of the female is brown along the anterior margin of the free border. The subtriangle on the hind wing of the female is divided into two or three cells. The lobes of the vulvar lamina are narrowly rounded at their apices (**Fig. 3.2.751**). Total length: 47 to 50 mm. Length of abdomen: 36 to 38.5 mm. Length of pterostigma in the fore-wing: 3.7 to 4.0 mm.

.....*Phyllogomphoides suspectus* Belle, 1994 (Rondônia, Mato Grosso).

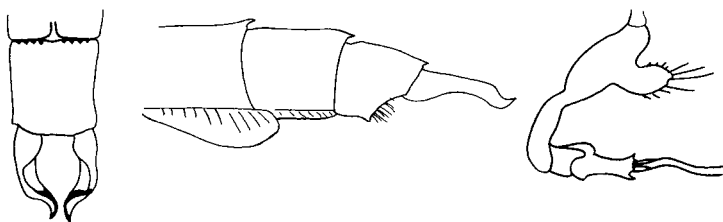


Fig. 3.2.752 *Phyllogomphoides cristatus* male (left to right): apex of the abdomen in dorsal and lateral view and the penis in lateral view. Based on Needham (1944).

17. There is a long, thin finger-like spine on the ventral side at the base of the superior anal appendage of the male. The only known female of a species in this group has lateral dilations of the eighth and ninth abdominal segments that are equal in width (**Fig. 3.2.750**).18
- There is no spine extending from the ventral surface of the superior anal appendage of the male, or there is only a small spine or tooth near its base (**Fig. 3.2.752**).24
18. Each superior anal appendage of the male has an obtuse apex that curves ventrad (**Fig. 3.2.753**).19
- Each superior anal appendage of the male has an acute apex that does not curve ventrad (**Fig. 3.2.750**).20
19. The pale collar of the male merges with the first pale antehumeral stripe (**Fig. 3.2.753**). The flagellum of the penis extends to about half the length of the third abdominal segment. The female has not been described.*Phyllogomphoides pseudoundulatus* Belle, 1984 (Pará).
- The pale collar of the male is separated from the first pale antehumeral stripe. The flagellum of the penis extends to about 2/3 the length of the third abdominal segment (**Fig. 3.2.754**). A description of the female is unavailable.*Phyllogomphoides undulatus* (Needham, 1944) (Venezuela, French Guiana, Surinam, Pará, Amapá). Syn: *Gomphoides undulatus* Needham, 1944; *Negomphoides undulatus* (Needham, 1944).

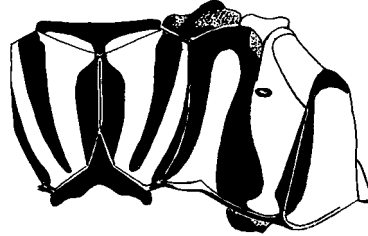


Fig. 3.2.753 Diagram of the color pattern on the synthorax of a male *Phyllogomphoides pseudoundulatus*. Based on Belle (1984d).

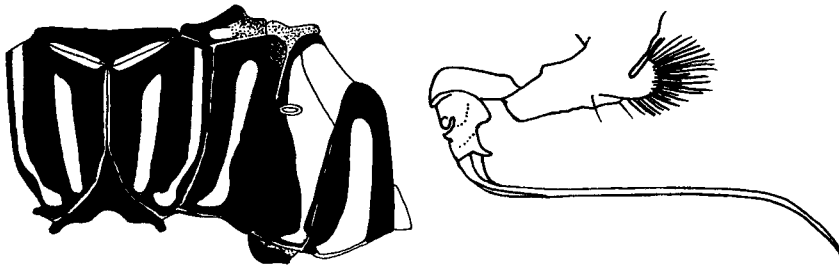


Fig. 3.2.754 *Phyllogomphoides undulatus* male: diagram of the color pattern on the synthorax (left) and penis in lateral view (right). Based on Belle (1984d).

20. The subtriangles in the hind wings are not crossed. Each anterior hamule ends in an acutely pointed posterior hook (**Fig. 3.2.750**).21

- The subtriangle in the hind wing is crossed (**Fig. 3.2.755**). Each anterior hamule is excised posteriorly.23

21. The peduncle of the penis, which is the seminal vesicle, is about half the length of the second abdominal segment and slender (**Fig. 3.2.750**). The female has not been described.

.....*Phyllogomphoides pedunculus* Belle, 1984
(Venezuela, Amazonas). Syn: *Phyllogomphoides atlanticus* (nec Belle, 1970) St. Quentin, 1973.

- The peduncle of the penis is about 1/3 the length of the second abdominal segment (**Fig. 3.2.756**).22

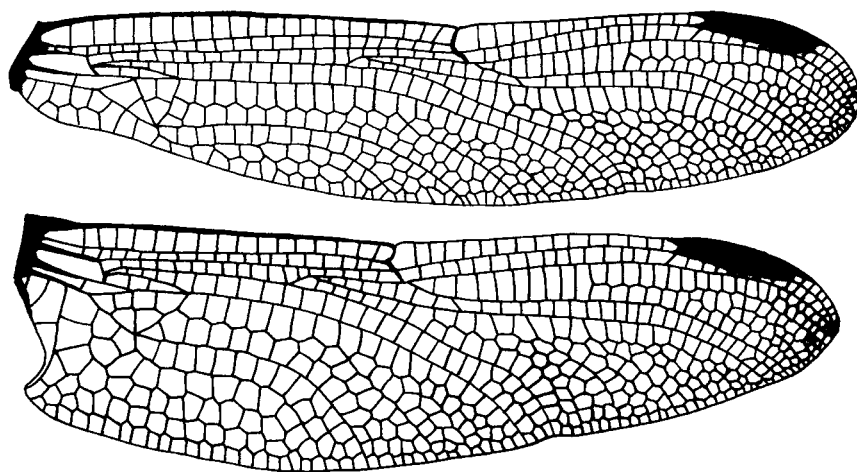


Fig. 3.2.755 Fore and hind wing of a male *Phyllogomphoides atlanticus*. Based on Belle (1970a).

22. The lateral dilations on the eighth and ninth abdominal segments of the male are approximately equal in width and relatively narrow (**Fig. 3.2.756**). The female has not been described. Total length: c. 49 mm. Length of abdomen: c. 38.5 mm. Hind wing length: c. 28.5 mm. Length of pterostigma of fore-wing: c. 3.8 mm.

.....*Phyllogomphoides angularis* Belle, 1982
(Venezuela, Rondônia, Amazonas, Pará).

- The lateral dilations on the ninth abdominal segment of the male are nearly twice as wide as those on the eighth segment (**Fig. 3.2.757**). The subtriangle in the hind wing of the female is open, and the second anal interspace begins at the anal vein with a single row two cells long followed by a double row two cells long. The labrum of the female is brown with pale lateral margins. Total length:

49 to 53 mm. Length of abdomen, including appendages: 30 to 31 mm. Length of pterostigma of fore-wing: 3.5 to 3.8 mm.

.....*Phyllogomphoides pseudangularis* Belle, 1994 (Amazonas).

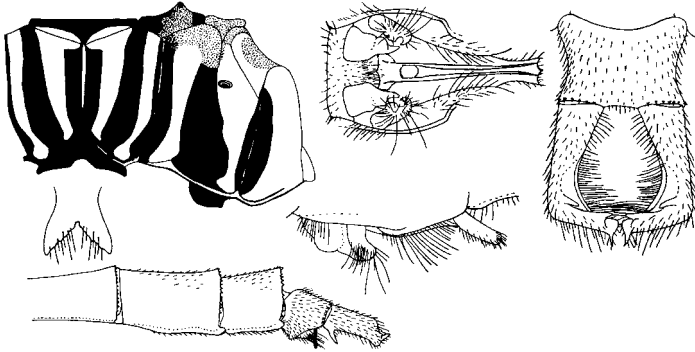


Fig. 3.2.756 *Phyllogomphoides angularis* male: diagram of the color pattern on the synthorax (upper left), genitalia on the second segment of the abdomen in ventral (above center) and lateral view (center), apex of the abdomen in dorsal (right) and lateral view (lower left), and apex of the inferior anal appendages in dorsal view (middle left). Based on Belle (1982b).

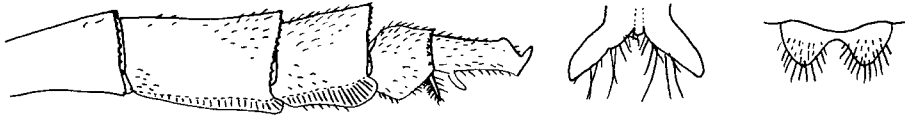


Fig. 3.2.757 *Phyllogomphoides pseudangularis* (left to right): apical abdominal segments of a male in lateral view, inferior anal appendage of a male in dorsal view, and vulvar lamina of a female in ventral view. Based on Belle (1994c).

23. There is a tooth on the superior surface of each superior anal appendage of the male, which is inserted about 2/3 of the distance from the base. The posterior part of the inner margin of the male hind wing is strongly concave (**Fig. 3.2.755**). The female has not been described.

.....*Phyllogomphoides atlanticus* (Belle, 1970) (French Guiana, Surinam, Brazil). Syn: *Negomphoides atlanticus* Belle, 1970.

- There is no tooth on the superior surface of the superior anal appendage (**Fig. 3.2.758**). Total length: c. 49 mm. Length of abdomen including appendages: c. 39 mm. Hind wing length: c. 31.5 mm. Length of pterostigma in fore-wing: c. 3.9 mm. The female has not been described.

.....*Phyllogomphoides aculeus* Belle, 1982 (Peru).

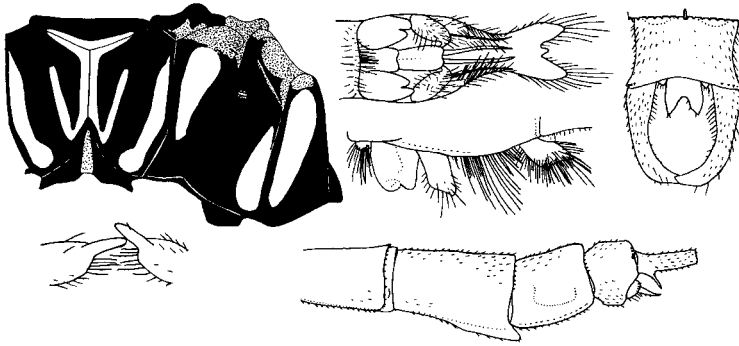


Fig. 3.2.758 *Phyllogomphoides aculeus* male: diagram of the color pattern on the synthorax (upper left), genitalia on the second segment of the abdomen in ventral (above center) and lateral view (center), apex of the abdomen in dorsal (upper right) and lateral view (lower right), and the apices of the superior anal appendages in posterior view (lower left). Based on Belle (1982b).

24. The inferior anal appendage consists of two rather long branches separated at a fork near the base. The thorax is brightly marked (**Fig. 3.2.759**).25
 - The apex of the very short inferior anal appendage is notched with a V-shaped incision (**Fig. 3.2.587**).26

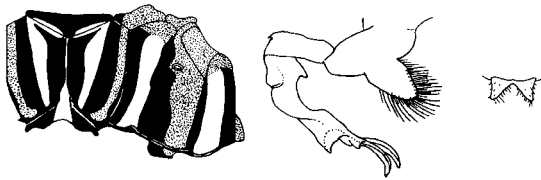


Fig. 3.2.759 *Phyllogomphoides regularis* (left to right): diagram of the color pattern on the thorax or a male, penis in lateral view, and vulvar lamina on the ninth abdominal segment of a female. Based on Belle (1984d).

25. The base of the excision in the inferior anal appendage is as wide as the length of each branch. The flagellum is clearly shorter than the subapical segment of the penis (**Fig. 3.2.759**). The subtriangle in the hind wing of the female consists of one to two cells. The face of the female is yellow with an apple green anteclypeus and some brown markings. There is a yellow line along the frontal margin of the costa of the female.

.....*Phyllogomphoides regularis* (Selys, 1873)
 (Minas Gerais, Santa Catarina, Rio Grande do Sul). Syn: *Gomphoides regularis* Selys, 1873.

- The base of the excision in the inferior anal appendage is $\frac{2}{3}$ as wide as the length of each branch. The flagellum of the penis is about as long as the subapical segment of the penis (**Fig. 3.2.760**). The subtriangle in the hind wing of the female consists of only one cell. The face of the female is greenish with brown on the anteclypeus and along the free border of the labrum. The frontal margin of the costa of the female is uniformly brown.

.....*Phyllogomphoides annectens* (Selys, 1869)
(Rio de Janeiro). Syn: probably *Gomphoides annectens* Selys, 1869.

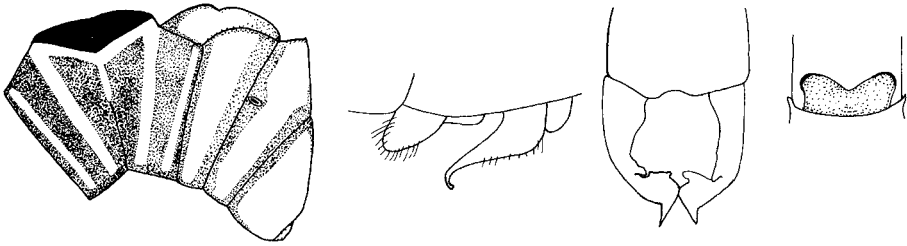


Fig. 3.2.760 *Phyllogomphoides annectens* (left to right): diagram of the color pattern on the thorax, lateral view of the male genitalia on the second abdominal segment, apex of the male abdomen showing the superior anal appendages, and vulvar lamina of a female. Based on Costa *et al.* (2000).

26. There is no tooth on the dorsal surface of each superior anal appendage of the male (**Fig. 3.2.752**). The free margin of the labrum of the female is black.

.....*Phyllogomphoides cristatus* (Needham, 1944)
(French Guiana, Surinam). Syn: *Gomphoides cristatus* Needham, 1944;
Negomphoides cristatus (Needham, 1944).

- There is a tooth inserted on the dorsal surface of each superior anal appendage about $\frac{2}{3}$ of the distance from the base (**Fig. 3.2.587**). 27

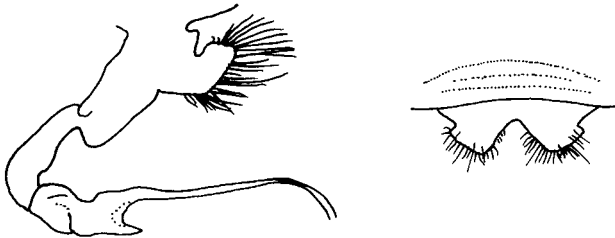


Fig. 3.2.761 *Phyllogomphoides semicircularis*: penis in lateral view (left) and vulvar lamina in ventral view (right). Based on Belle (1982b).

27. The inner margin of each anterior hamule is excised. The dorsal side of the prothorax of the female is entirely black. There is a V-shaped excision along the

midline of the vulvar lamina that extends 2/3 of its length (**Fig. 3.2.761**). Total length: c. 56 mm. Length of abdomen including appendages: c. 43 mm. Hind wing length: c. 38 mm. Pterostigma length in fore-wing: c. 5.0 mm.

.....*Phyllogomphoides semicircularis* (Selys, 1854) (Colombia, Venezuela). Syn: *Gomphoides semicircularis* Selys, 1854. This species was recommended for consideration as an endangered species in Venezuela (DeMarmels, 1999).

- Only the posterior margin of the anterior hamule is excised (**Fig. 3.2.587**). ...28. The labrum is entirely reddish brown. There is a pale, double mid-dorsal spot on the prothorax of the female. The vulvar lamina has a V-shaped excision that extends for 3/4 of its length (**Fig. 3.2.587**). Total length: 56 to 58 mm. Length of abdomen: 43 to 45 mm. Hind wing length: c. 38 mm. Length of pterostigma of fore-wing: 4.0 to 4.2 mm. The thorax is brown with yellow markings, and the abdomen is blackish brown with yellow and brownish yellow markings.

.....*Phyllogomphoides brunneus* Belle, 1981 (Ecuador, Peru, Venezuela). This species was recommended for consideration as an endangered species in Venezuela (DeMarmels, 1999).

- The labrum is marked by a pair of pale spots. The markings on the thorax vary considerably (**Fig. 3.2.762**). The subtriangle in the hind wing of the female usually has two cells but sometimes has only one. The vulvar lamina has lobes that are bluntly rounded at the apex.

.....*Phyllogomphoides lieftincki* (Belle, 1970) (Ecuador, Peru, Bolivia). Syn: *Negomphoides lieftincki* Belle, 1970.

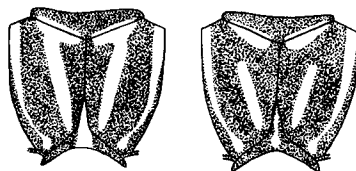


Fig. 3.2.762 Two alternate patterns on the dorsal surfaces of the synthoraces of male *Phyllogomphoides lieftincki*. Based on Belle (1972a).

Key to the species of known *Phyllogomphoides* larvae in South America

Information for the key was provided by Costa *et al.* (1999). The larvae of most species have not been described.

1. There is no trace of a dorsal hook on the second abdominal segment; they are present on the third through ninth. The fore and middle tibiae lack spines. The inner margin of the labial palp is smooth (**Fig. 3.2.607**). Total length: c. 30 mm.

.....*Phyllogomphoides annectens* (Selys, 1869) (Rio de Janeiro). Syn: probably *Gomphoides annectens* Selys, 1869.

- Dorsal hooks are present on the second through ninth abdominal segments, although that on the second may be represented by a slight prominence (**Fig. 3.2.763**).2

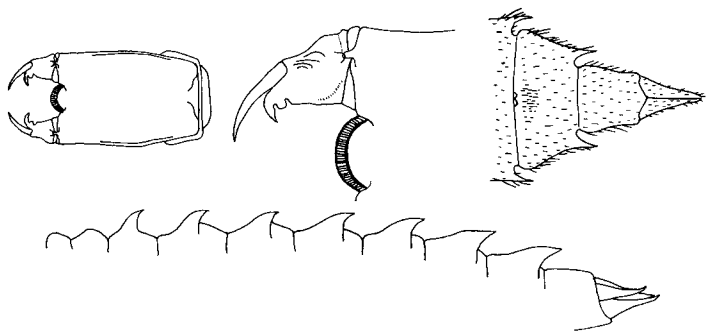


Fig. 3.2.763 *Phyllogomphoides andromeda* larva (above, left to right): labium, median lobe and labial palp, apex of the abdomen in ventral view, and (below): dorsal and apical profile of the abdomen. Based on Belle (1970a).

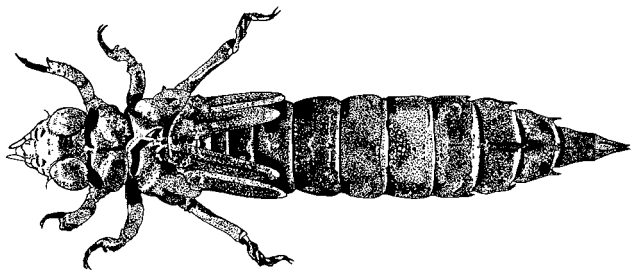


Fig. 3.2.764 Exuvia of a *Phyllogomphoides major* larva. Based on Belle (1970a), who illustrated it as *Phyllogomphoides fuliginosus* and later reassigned it (Belle, 1984d).

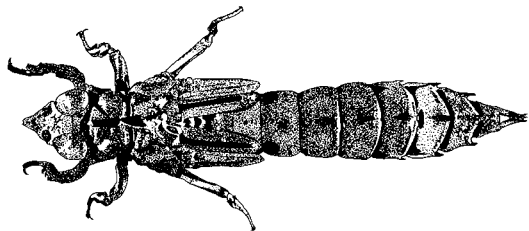


Fig. 3.2.765 Exuvia of a *Phyllogomphoides fuliginosus* larva. Based on Belle (1970a), who illustrated it as *Phyllogomphoides audax* and later reassigned it (Belle, 1984d).

3. The ninth abdominal segment is slightly shorter than the tenth (**Fig. 3.2.764**). Total length: up to c. 44 mm.

.....*Phyllogomphoides major* Belle, 1984 (Venezuela, Guyana, French Guiana, Surinam, Pará). The two species in this couplet are very similar (Belle, 1984d) and may prove to be conspecific in spite of the size difference.

- The ninth and tenth abdominal segments are subequal in length (**Fig. 3.2.765**). Total length: up to c. 37.5 mm.

.....*Phyllogomphoides fuliginosus* (Hagen in Selys, 1854) (French Guiana, Surinam, Venezuela, Brazil). Syn: *Gomphoides fuliginosus* Hagen in Selys, 1854.

4. There is only one tooth on the palpal lobe (**Fig. 3.2.763**). Total length: up to c. 27 mm. Length of abdomen: c. 18 mm.

.....*Phyllogomphoides andromeda* (Selys, 1869) (Venezuela, French Guiana, Guyana, Surinam, Argentina, Pará, Paraná). Syn: *Cyclophylla andromeda* Selys, 1869.

- There are two teeth on the palpal lobe (**Fig. 3.2.766**). 5
5. There are two small teeth about equal in size on the end hook of the palpal lobe. The ninth and tenth abdominal segments are subequal in length (**Fig. 3.2.766**). Total length: up to c. 28 mm.

.....*Phyllogomphoides undulatus* (Needham, 1944) (Venezuela, French Guiana, Surinam, Pará, Amapa). Syn: *Gomphoides undulatus* Needham, 1944; *Negomphoides undulatus* (Needham, 1944).

- There are two unequally large teeth on the end hook of the palpal lobe. The ninth abdominal segment is clearly shorter than the tenth (**Fig. 3.2.767**). Total length: up to c. 35 mm.

.....*Phyllogomphoides cristatus* (Needham, 1944) (French Guiana, Surinam). Syn: *Gomphoides cristatus* Needham, 1944; *Negomphoides cristatus* (Needham, 1944).

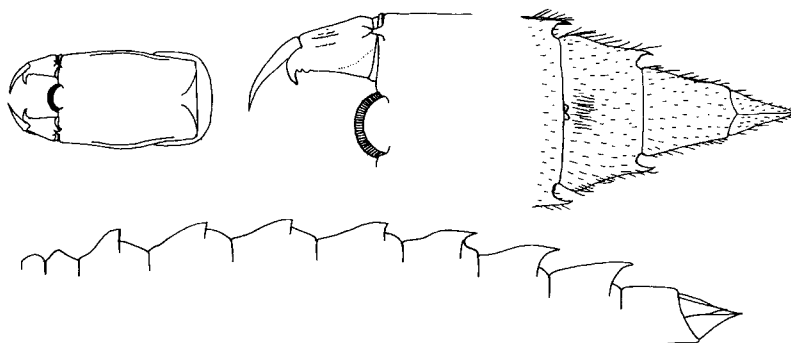


Fig. 3.2.766 *Phyllogomphoides undulatus* larva (above, left to right): labium of an exuvia, enlarged median lobe and labial palp, apex of the abdomen in ventral view, and (below) dorsal and posterior profile of the abdomen. Based on Belle (1970a).

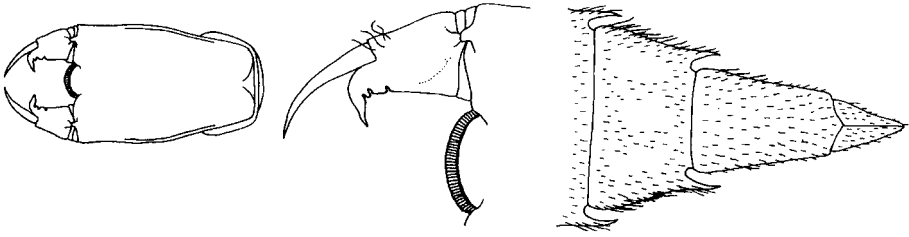


Fig. 3.2.767 *Phyllogomphoides cristatus* larva (left to right): labium of an exuvia, enlarged median lobe and labial palp, and apex of the abdomen in ventral view. Based on Belle (1970a).

Key to the species of adult *Cyanogomphus* in South America

Information for the key was provided by Williamson (1916) and Belle (1966b, 1970a, 1972a, 1980b, 1986b, 1994d).

1. In the hind wing of the male, there are two cells bordering the anal vein. The anterointernal tooth on the anterior hamule is set relatively low and is obviously rounded (**Fig. 3.2.768**). Total length of male: c. 42.5 mm. Length of male abdomen: c. 34.5 mm. Hind wing length of male: 22.5 mm. This species was described from a badly damaged, teneral male specimen, and many of its features, including coloration, could not be observed.

.....*Cyanogomphus schroederi* Belle, 1970 (Pará).

- In the hind wing of the male, there is usually only one large cell bordering the anal vein (**Fig. 3.2.769**).2

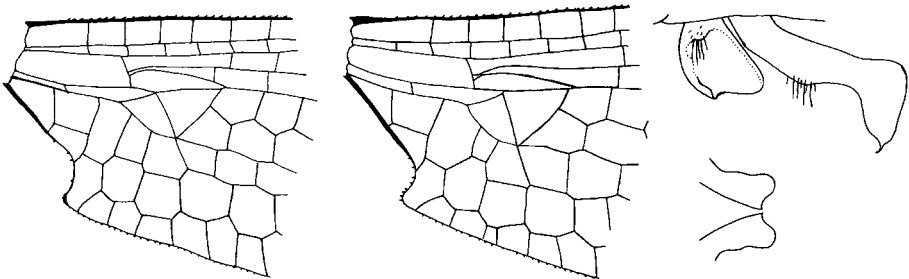


Fig. 3.2.768 *Cyanogomphus schroederi* male (left to right): bases of the hind wings of a specimen, which show minor differences in venation; genital hamules on the second abdominal segment in lateral view (above); apices of the anterior hamules in anterior view (below). Based on Belle (1970a).

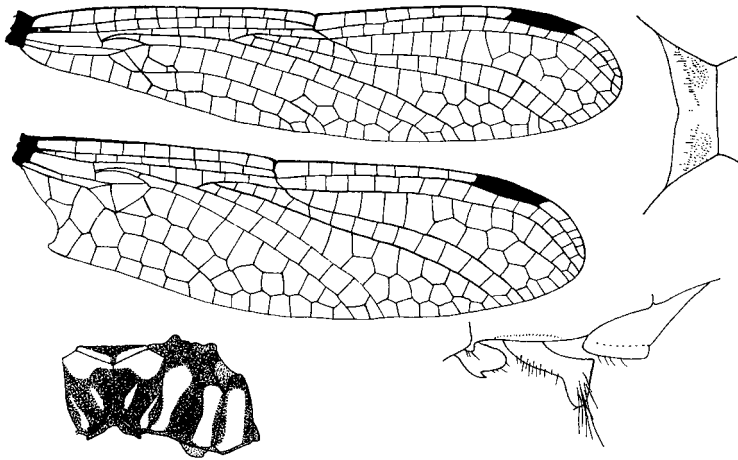


Fig. 3.2.769 *Cyanogomphus pumilus* male: fore and hind wing (upper left), diagram of the color pattern on the synthorax (lower left), occiput in dorsal view (upper right), and the male genitalia on the second abdominal segment in lateral view (lower right). Based on Belle (1986b).

2. There is a distinct ridge on the occiput, the posterior part of the head (**Fig. 3.2.770**). 3
 - There is no ridge on the occiput, which is evenly rounded or somewhat concave; where the crest would be present in other species, only a line of hair-like setae is present. The hind tibia of the male bears a row of modified setae, swollen at the base, which line less than $2/3$ of the length of the tibia; the basal setae in this row are longer than half the width of the tibia (**Fig. 3.2.769**). 4

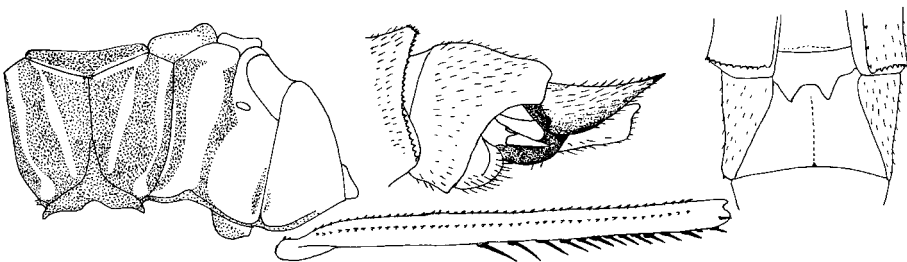


Fig. 3.2.770 *Cyanogomphus waltheri* (above, left to right): diagram of the color pattern on the synthorax of a male, apex of the male abdomen in lateral view, and the ninth abdominal segment of a female in ventral view showing the vulvar lamina, and (below) the hind tibia of a male. Based on Belle (1980b).

3. There is no broad green middorsal stripe on the thorax, but there are two pairs of antehumeral stripes. The tibiae are predominantly black. The apical branches on the inferior anal appendage are deeply excavated on the dorsal surface (**Fig. 3.2.770**). There are three distal rows of cells posterior to Cu_2 in both the fore and hind wings and two rows of postrigonal cells in the hind wing. Total length: about 42 to 45 mm. Length of abdomen: 31 to 33 mm. Hind wing length of male: 23.5 to 24.5 mm; female: c. 28.5 mm.

.....*Cyanogomphus waltheri* Selys, 1873 (Argentina, Rio de Janeiro, Goiás, Santa Catarina, Rio Grande do Sul).

- There is a broad green middorsal stripe on the thorax. The tibiae are predominantly yellow. The apical branches on the inferior anal appendage are convex on the dorsal surface (**Fig. 3.2.771**). There are two distal rows of cells posterior to Cu_2 in the hind wing. Total length of the male: c. 39 mm. Length of male abdomen: c. 36 mm. Hind wing length of male: c. 22.5 mm. Length of pterostigma of the fore-wing measured along the costa: 3.1 mm. The female has not been described.

.....*Cyanogomphus comparabilis* Belle, 1994 (São Paulo, Mato Grosso).

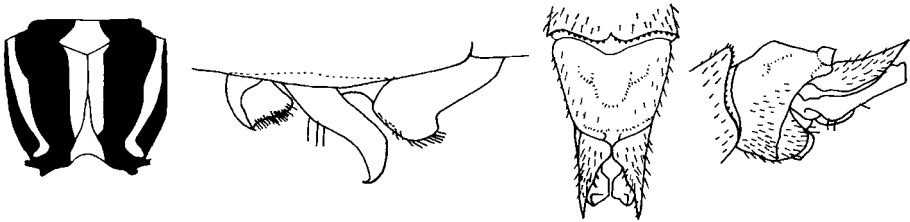


Fig. 3.2.771 *Cyanogomphus comparabilis* male (left to right): dorsal color pattern of dark brown and green or yellow, genitalia on the second abdominal segment in lateral view, and apex of the abdomen in dorsal and lateral view. Based on Belle (1994d).

4. There are two distal rows of cells posterior to Cu_2 in the fore-wing, and three rows are present in the hind wing. Three cells border the distal side of the triangle in the hind wing, and two rows of postrigonal cells run from the triangle in the fore-wing and then form three or more rows (**Fig. 3.2.772**). Length of male abdomen: c. 32 mm. Hind wing length of male: c. 23.5 mm.

.....*Cyanogomphus conchinus* Williamson, 1916 (Guyana, French Guiana, Surinam). Syn: *Ebegomphus conchinus* (Williamson, 1916).

- There is one row of cells posterior to Cu_2 in the fore wing, and two rows are present in the hind wings. Two cells border the apical side of the triangle in the hind wing, and one row of postrigonal cells in the hind wing run at least for a distance of three cells distal to the triangle (**Fig. 3.2.769**).5

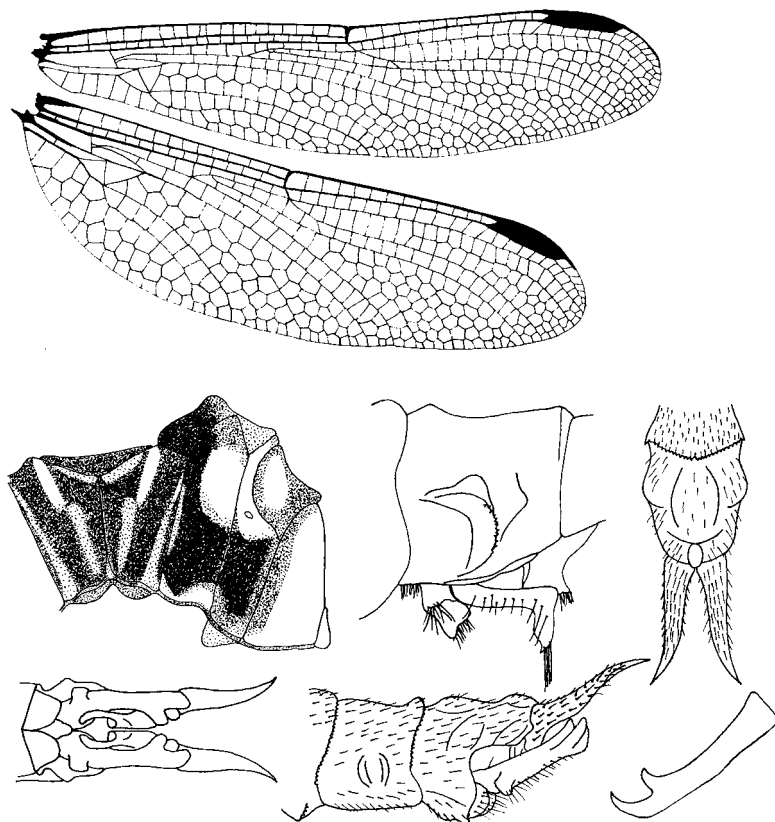


Fig. 3.2.772 *Cyanogomphus conchinus*: fore and hind wing of a female (above), diagram of the color pattern on the male thorax (middle left), male genitalia on the second abdominal segment in lateral view (center), apex of the male abdomen in dorsal (middle right), ventral (lower left), and lateral view (lower center), and the tarsal claw (lower right). Based on Williamson (1916) and Belle (1966b, 1970a).

5. There is only a single row of post-trigonal cells in both the fore and hind wing (**Fig. 3.2.769**). There is a middorsal spine on the fourth and the fifth abdominal segment, that on the fourth much smaller than the one on the fifth. Total length of the male: c. 35 mm. Length of male abdomen: c. 28 mm. Hind wing length of male: c. 18.5 mm. Length of pterostigma measured along the costal vein of the fore-wing: 2.2 mm. The female has not been described. Color: mainly light brown with pale green markings on the thorax and abdomen.

.....*Cyanogomphus pumilus* Belle, 1986
(Venezuela).

- The row of post-trigonal cells in one of the wings is more than one cell wide (Fig. 3.2.773).6

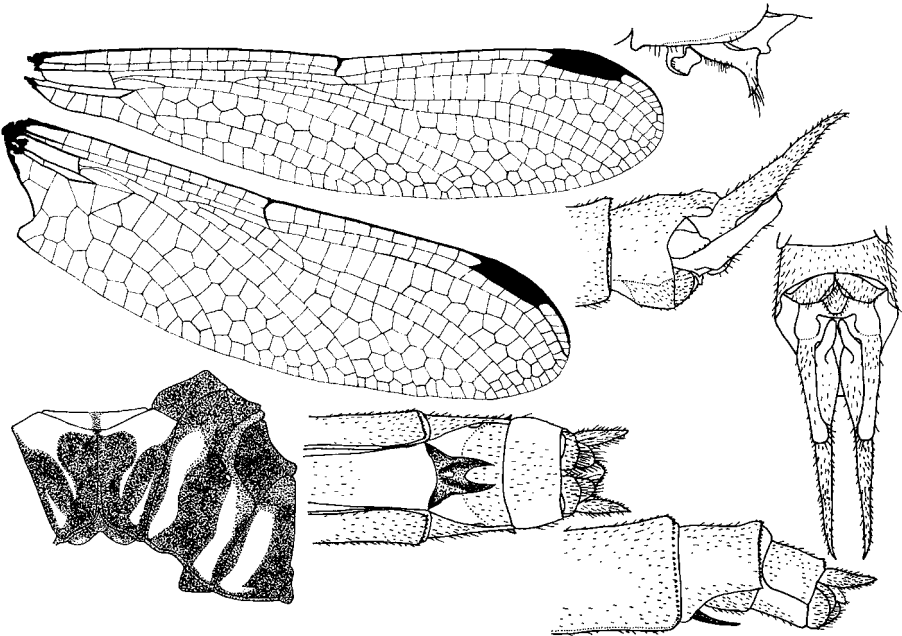


Fig. 3.2.773 *Cyanogomphus minutus*: fore and hind wing (upper left), diagram of the color pattern on the synthorax (lower left), male genitalia on the second abdominal segment in lateral view (upper right), apex of the male abdomen in ventral (lower middle right) and lateral view (upper middle right), and the apex of the female abdomen in ventral (lower center) and lateral view (lower right). Based on Belle (1970a).

6. The fourth and fifth abdominal segments lack middorsal spines. The vulvar lamina extends almost to the posterior margin of the ninth abdominal sternite of the female and ends in two acutely pointed apices separated by a deep, narrow emargination (**Fig. 3.2.773**).

.....*Cyanogomphus minutus* Belle, 1970 (French Guiana, Surinam, Venezuela).

- There is a middorsal spine on the fourth and the fifth abdominal segment, that on the fourth much smaller than the one on the fifth (**Fig. 3.2.576**).

.....*Cyanogomphus demerarae* Selys, 1894 (Guyana, Surinam). Syn: *Ebegomphus demerarae* (Selys, 1894); *Ebegomphus strumens* Needham, 1944.

Key to the species of known *Cyanogomphus* larvae in South America

Information for the key was provided by Needham (1940, 1944) and Belle (1966b, 1970a, 1986b).

1. The mid-dorsal spine on the eighth abdominal segment is rudimentary and much shorter than that on the ninth. The lateral spines on the abdominal segments are short and acutely pointed (**Fig. 3.2.774**).

..... *Cyanogomphus waltheri* Selys, 1873 (Argentina, Rio de Janeiro, Goiás, Santa Catarina, Rio Grande do Sul).

- Other mid-dorsal spines are as long or longer than that on the ninth abdominal segment (**Fig. 3.2.775**).2

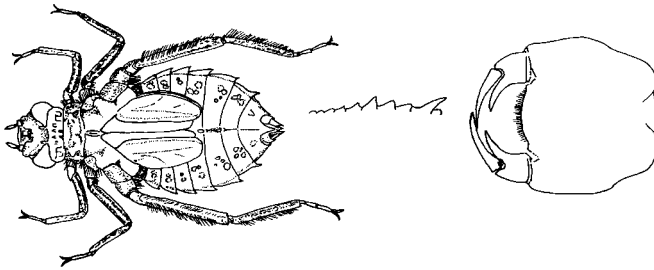


Fig. 3.2.774 *Cyanogomphus waltheri* larva (left to right): habitus, lateral profile of the dorsal surface of the abdomen, labium. Based on Needham (1940), whose identification of this specimen was tentative.

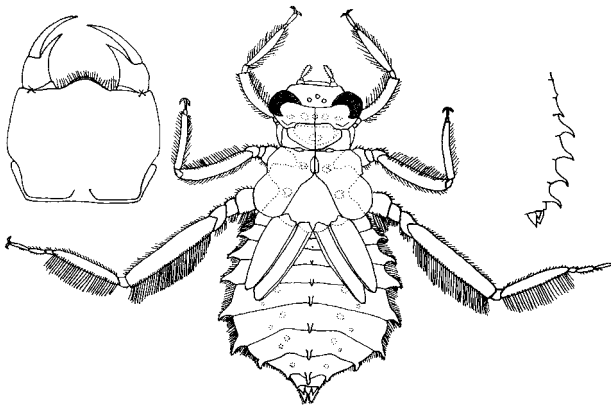


Fig. 3.2.775 *Cyanogomphus conchinus* larva: probable habitus from an exuvia (center), labium (upper left), and lateral profile of the dorsal surface of the abdomen (upper right). Based on Belle (1966b), who assumed his larva to be *Ebegomphus conchinus* from its association with the adults.

2. There are robust mid-dorsal spines only on the sixth through ninth abdominal segments, with barely a trace of a mid-process on the first five segments. The lateral processes on the abdominal segments are coarse and blunt (**Fig. 3.2.609**). Total length of exuvia: c. 12.5 mm. Length of abdomen: c. 8 mm.

..... *Cyanogomphus minutus* Belle, 1970
(French Guiana, Surinam, Venezuela).

- There is a recognizable mid-dorsal process on the fifth abdominal segment and sometimes those anterior to the fifth (**Fig. 3.2.775**). The length of the final instar larvae is greater than 12.5 mm. 3

3. The mid-dorsal processes on the sixth through ninth abdominal segments are approximately equal in size, while that on the fifth is shorter but well formed, and only a small elevation is present on the fourth. The body and legs are coated with fine setae, and the lateral spines on the abdominal segments are hooked and acutely pointed (**Fig. 3.2.775**).

..... *Cyanogomphus conchinus* Williamson, 1916
(Guyana, French Guiana, Surinam). Syn: *Ebegomphus conchinus* (Williamson, 1916).

- A relatively small but well-formed mid-dorsal spine is present on the fourth abdominal segment, or, if only a vestige is visible on the fourth segment, then the lateral spines on the abdominal segments are coarse and broadly rounded (**Fig. 3.2.776**). 4

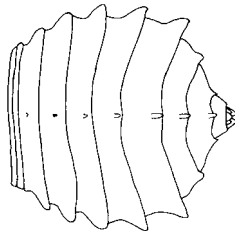


Fig. 3.2.776 Abdomen of *Cyanogomphus demerarae* in dorsal view. Based on Needham (1944), who referred to it by its synonym, *Ebegomphus strumens*.

4. The mid-dorsal spine on the ninth abdominal segment does not cover half of the length of the tenth segment. The lateral processes on the abdominal segments are coarse and broadly rounded (**Fig. 3.2.776**).

..... *Cyanogomphus demerarae* Selys, 1894
(Guyana, Surinam). Syn: *Ebegomphus demerarae* (Selys, 1894); *Ebegomphus strumens* Needham, 1944.

- The mid-dorsal spine on the ninth abdominal segment extends posteriad to cover the tenth segment. There are high, robust mid-dorsal processes with short setae on their posterior surfaces on the fifth through ninth abdominal segments. The mid-dorsal process on the fifth segment is more slender than those posterior to it, and that on the fourth is smaller but well-formed (**Fig. 3.2.777**).

..... *Cyanogomphus pumilus* Belle, 1986
(Venezuela).

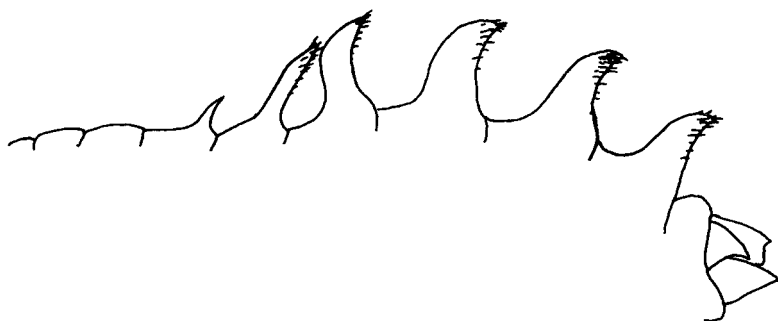


Fig. 3.2.777 Outline of the dorsal surface and apex of the abdomen of a final instar larva of *Cyanogomphus pumilus* in lateral view. Based on Belle (1986b).

Key to the adults of the genus *Tibiagomphus* in South America

Information for the key was provided by Fraser (1947a), Belle (1970a, 1996), and Rodrigues Capitulo (1984). These two species are very similar and difficult to distinguish. A better description of *T. uncatus* would help demonstrate whether or not both of these nominal species are valid. An adequate description of the larva of *Tibiagomphus uncatus* is not yet available.

1. The anterior margin of the male frons, in dorsal view, is evenly curved or nearly straight in the middle. The deep median cleft in the vulvar lamina is longer than $2/5$ of the length of the lamina. The row of setae on the hind tibia of the male lines more than $3/4$ of its length, and all of these setae are shorter than half the width of the tibia (**Fig. 3.2.778**). Total length of the female: 40 to 44 mm. Length of abdomen: 30 to 33 mm. Hind wing length of male: 20 to 25 mm.

.....*Tibiagomphus uncatus* (Fraser, 1947)
(Argentina, Uruguay, Paraguay, Santa Catarina).

- The anterior margin of the male frons is broadly produced in the middle so that the anterior outline on either side is concave. The median cleft in the vulvar lamina is no longer than about $1/3$ of the length of the lamina (**Fig. 3.2.589**). There are two rows of post-trigonal cells in the hind wing. A basal subcostal vein is present. All tibiae are lined with long, spine-like setae. Total length: 37 to 41 mm. Length of abdomen: 28.5 to 31 mm. Hind wing length of male: 23 to 26.5 mm. Length of pterostigma: c. 3.3 mm. The predominant colors of immature males are ochraceous and light brown; the thorax is dark red with yellow stripes. The head of the male is mainly yellow and light brown with dark red antennae. The head of the female is mainly brown. The female has a similar pattern but is more brightly colored. The wings are hyaline, and the pterostigma is brown, somewhat lighter in the male.

.....*Tibiagomphus noval* (Rodrigues Capitulo, 1984)
(Argentina).

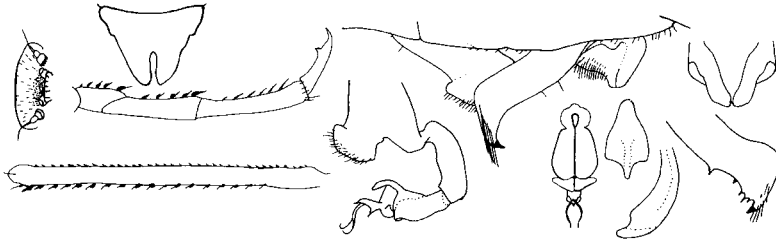


Fig. 3.2.778 *Tibiogomphus uncatus*: anterior margin of the head of a male with the ocellae and antennae (left), the right hind tibia (lower left) and right hind tarsi with claw of a male (above tibia), male genitalia on the second abdominal segment in right lateral view (upper right center), penis in right lateral (lower center) and ventral view (right of the lateral view), penis guard in ventral and right lateral view (lower right center, above and below, respectively), anterior hamule in anterior view (upper right), and posterior hamule in left lateral view (lower right), vulvar scale of a female (upper left center). Note that the genital organs, except the posterior hamule, are oriented with the head of the insect to the right. Based on Belle (1972a, 1980b), Rodrigues Capitulo (1984).

Key to the species of adult *Agriogomphus* in South America

Information for the key was provided by Belle (1966b, 1975c).

1. There is only a single row of posttrigonal cells in the fore-wing (**Fig. 3.2.592**). The compound eyes are mottled olive and green. The head is otherwise pale brown to cream with brown markings. The thorax is brownish dorsally and yellowish laterally. The abdomen is reddish brown with the first three segments mainly cream and cream markings on the basal parts of the fourth, sixth, and seventh segments. The anal appendages are pale. Length of male abdomen: c. 27.5 mm. Hind wing length of male: c. 22 mm. Length of pterostigma in the fore-wing of a male along the costal margin: c. 2.9 mm.

..... *Agriogomphus silvicola* Selys, 1869 (Surinam, Colombia, Peru, Brazil south to São Paulo). Syn: *Agriogomphus aquicola* Fraser, 1943.

- There is a double row of posttrigonal cells in the fore-wing (**Fig. 3.2.779**).2
2. The mid-ventral length of the ninth abdominal segment is $\frac{3}{4}$ of the mid-dorsal length. There is a single row of posttrigonal cells in the hind wing (**Fig. 3.2.779**). Total length: c. 40 to 41 mm. Length of abdomen: c. 32 mm. Hind wing length: c. 23 to 25 mm. Length of pterostigma in the fore-wing of a male along the costal margin: c. 3 mm; female: c. 2.7 mm.

..... *Agriogomphus ericae* (Belle, 1966) (Surinam). Syn: *Ischnogomphus ericae* Belle, 1966.

- The mid-ventral length of the ninth abdominal segment is $\frac{2}{3}$ of the mid-dorsal length (**Fig. 3.2.780**).

.....*Agriogomphus jessei* (Williamson, 1918)
(Colombia, Peru, Colombia, Venezuela). Syn: *Ischnogomphus jessei*
Williamson, 1918. This species was recommended for consideration as an
endangered species in Venezuela (DeMarmels, 1999).

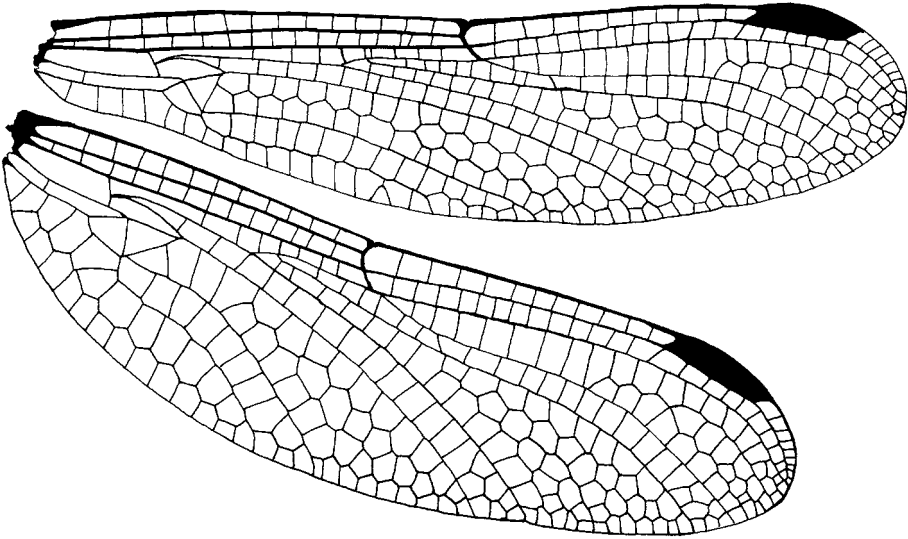


Fig. 3.2.779 Fore and hind wing of a female *Agriogomphus ericae*. Based on Belle (1966b).

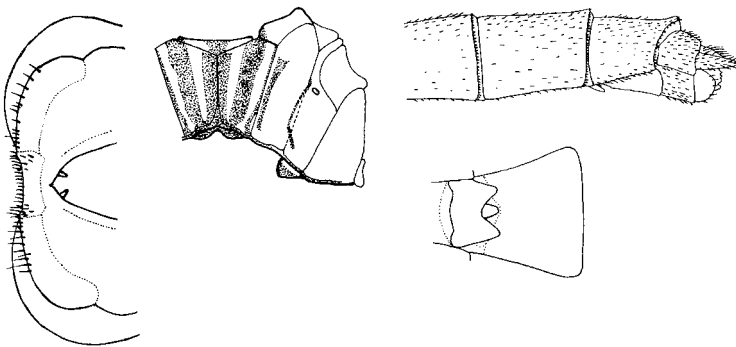


Fig. 3.2.780 *Agriogomphus jessei* female (left to right): dorsal part of head in posterior view showing the occipital spines, diagram of the color pattern on the synthorax, apex of the abdomen in lateral view (above), and the vulvar lamina on the ninth abdominal segment in ventral view. Based on Belle (1972a).

Key to the adult males of the genus *Archaeogomphus* in South America

Information for the key was provided by Belle (1982a, 1994d). The male of *Archaeogomphus vanbrinkae* has not yet been described.

1. The posterior margins of the hind wings are not distinctly angulate at the base (**Fig. 3.2.781**). Total length: 27 to 29 mm. Hind wing length: 13.7 to 15.5 mm.
.....*Archaeogomphus nanus* Needham, 1944
(French Guiana, Surinam, Venezuela, Rondônia, Mato Grosso, Roraima).
- The posterior margins of the hind wings are strongly angulate at the base (**Fig. 3.2.588**).2

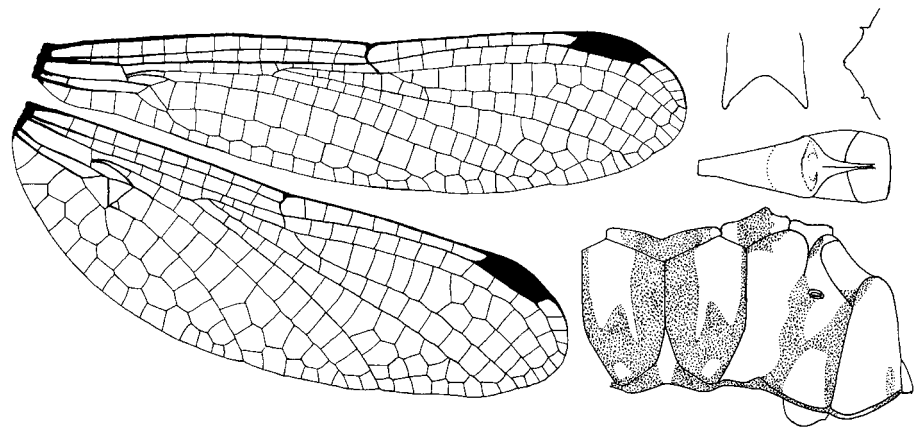


Fig. 3.2.781 *Archaeogomphus nanus*: fore and hind wing of a female (upper left), diagram of the color pattern on the synthorax of a male (lower right), peduncle of the penis in posterior view (upper right center), dorsal margin of the occipital foramen of a female in posterior view (upper right), vulvar lamina in ventral view (middle right). Based on Belle (1970a, 1982a).

2. The lateral dilations of the eighth abdominal segment are well developed and strongly widened posteriad and extend nearly to the midlength of the ninth segment (**Fig. 3.2.588**).3
- The lateral dilations of the eighth abdominal segment are narrow (**Fig. 3.2.782**).5
3. There are three rows of cells between veins M_1 and M_2 (**Fig. 3.2.588**). Total length: 31 to 33 mm. Hind wing length: 19 to 20 mm.
.....*Archaeogomphus densus* Belle, 1982
(Argentina, Minas Gerais).
- There are two rows of cells between veins M_1 and M_2 (**Fig. 3.2.1**).4

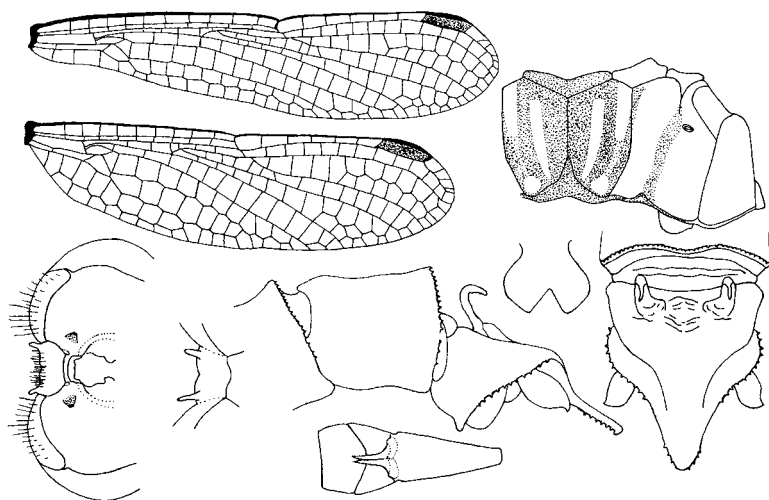


Fig. 3.2.782 *Archaeogomphus furcatus*: fore and hind wing (upper left), pattern on the thorax of a male with unshaded areas yellowish brown and the stippled areas brown or black (upper right), the occipital region of the head showing the horns, which are shown again enlarged to the right (lower left), the ninth and tenth abdominal segments with appendages in lateral view (center) and their apex in dorsal view (lower right), posterior view of the apex of the penis (right of center), and the vulvar lamina (lower center). Based on Williamson (1923c) and Belle (1982a).



Fig. 3.2.783 *Archaeogomphus globulus*: genitalia on the second abdominal segment and knob-like process on the third abdominal segment of a male (upper left), transverse laminae on the male genitalia of two specimens in posterior view (lower left), and the vulvar lamina of a female in ventral view (right). Based on Belle (1994d).

4. There is a dark, knob-like ventral process on the third abdominal segment just posterior to the transverse lamina of the genitalia (**Fig. 3.2.783**). The dorsal posterior margin of the ninth abdominal segment is nearly evenly convex. Total length: 36 to 38 mm. Abdomen length: 27 to 29 mm. Hind wing length: 22 to 22.5 mm. Coloration: mainly dark brown with a grayish green face and brown and yellow markings on the legs.

.....*Archaeogomphus globulus* Belle, 1994
(Paraná, Santa Catarina).

- There is no dark, knob-like ventral process on the third abdominal segment just posterior to the transverse lamina of the genitalia. The posttrigonal cells form a single row in both the fore and hind wing (**Fig. 3.2.1**). Total length: 35 mm. Hind wing length: 19.5 mm.

.....*Archaeogomphus infans* (Ris, 1913)
(Espírito Santo, São Paulo). Syn: *Agriogomphus infans* Ris, 1913,

5. In posterior view, the ventral margin of the penial peduncle has a deep V-shaped excision. The posterior part of the occiput bears two spines or horns that are directed posteriad (**Fig. 3.2.782**). Length of abdomen of male and female: about 24 mm. Length of hind wing of male: about 18.5 mm; female: 19 to 20 mm. Coloration: mainly brownish yellow, brown, greenish, and black.

.....*Archaeogomphus furcatus* Williamson, 1923
(Mexico, Central America, Colombia, Venezuela).

- In posterior view, the ventral margin of the penial peduncle is broad, concave, and has a shallow median notch (**Fig. 3.2.784**). There are no spines or horns on the posterior part of the occiput.

.....*Archaeogomphus hamatus* (Williamson, 1918)
(Colombia, Guyana, Surinam, Goiás). Syn: *Agriogomphus hamatus* Williamson, 1918.

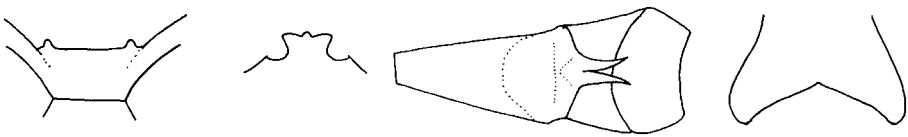


Fig. 3.2.784 *Archaeogomphus hamatus* (left to right): occiput of a female in posterior view, dorsal margin of the occipital foramen of a female, vulvar lamina in ventral view, and the peduncle of the penis in posterior view. Based on Belle (1982a).

Key to the adult females of the genus *Archaeogomphus* in South America

Information for the key was provided by Belle (1982a) and Machado (1994b).

1. There is a pair of long spines directed posteriad from the posterior edge of the occiput (**Fig. 3.2.785**).2
 - If any prominences are present on the posterior edge of the occiput, they are small (**Fig. 3.2.784**).3

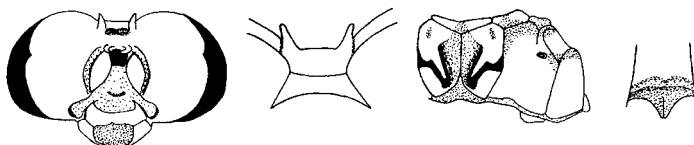


Fig. 3.2.785 *Archaeogomphus vanbrinkae* female (left to right): posterior view of the head, dorsal view of occiput, diagram of the color pattern on the synthorax, and the vulvar lamina. Based on Machado (1994b).

2. There are no hook-like prominences on the superior margin of the occipital foramen (**Fig. 3.2.782**).

.....*Archaeogomphus furcatus* Williamson, 1923
(Mexico, Central America, Colombia, Venezuela).

- There are two hook-like prominences directed medially on the superior margin of the occipital foramen (**Fig. 3.2.785**). Total length: 31.2 mm; hind wing length: 19.2 mm. Color of thorax: yellowish and olive brown with a black pattern laterally. The abdomen is brown with black rings. The wings are hyaline. The male has not been described.

.....*Archaeogomphus vanbrinkae* Machado, 1994
(Mato Grosso). Gender corrected from *A. vanbrinki* Machado, 1994.

3. There is a small prominence at each lateral end of the occiput (**Fig. 3.2.784**). Total length: 30 to 33 mm. Hind wing length: 18 to 19 mm.

.....*Archaeogomphus hamatus* (Williamson, 1918)
(Colombia, Guyana, Surinam, Goiás).

- The posterior edge of the occiput lacks any prominences or protruding angles (**Fig. 3.2.588**).4

4. There are three rows of cells between veins M_1 and M_2 (**Fig. 3.2.588**). Total length: 31 mm. Hind wing length: 20 mm.

.....*Archaeogomphus densus* Belle, 1970
(Argentina, Minas Gerais).

- There are two rows of cells between veins M_1 and M_2 (**Fig. 3.2.1**).5

5. There are angled lateral processes formed on the vulvar lamina (**Fig. 3.2.783**). Total length of female: c. 36 mm. Length of female abdomen: c. 27 mm. Hind wing length of female: c. 22.5 mm. Length of pterostigma in the fore-wing

measured along the costal margin: 2.4 to 2.6 mm. Color: mainly dark brown with a grayish green face and brown and yellow legs.

.....*Archaeogomphus globulus* Belle, 1994
(Paraná, Santa Catarina).

- There are no angled lateral processes formed on the vulvar lamina (**Fig. 3.2.781**).6

6. The superior margin of the occipital foramen bears a pair of submedian spines. The posttrigonal cells form a single row in both the fore and hind wing (**Fig. 3.2.1**).

.....*Archaeogomphus infans* (Ris, 1913)
(Espírito Santo, São Paulo).

- The superior margin of the occipital foramen lacks spines (**Fig. 3.2.781**).

.....*Archaeogomphus nanus* Needham, 1944
(Surinam, Venezuela, Rondônia, Mato Grosso, Roraima).

Key to the species of *Archaeogomphus* larvae in South America

Information for the key was provided by Belle (1970a, 1992a). The larvae of only two species have been described.

1. The mid-dorsal spine on the ninth abdominal segment reaches to the posterior border of the tenth segment. The wing cases are held nearly parallel (**Fig. 3.2.593**).

.....*Archaeogomphus furcatus* Williamson, 1923
(Mexico, Central America, Colombia, Venezuela).

- The mid-dorsal spine on the ninth abdominal segment is shorter than the lateral spines on that segment and covers no more than half of the length of the tenth segment. The wing cases diverge (**Fig. 3.2.786**).

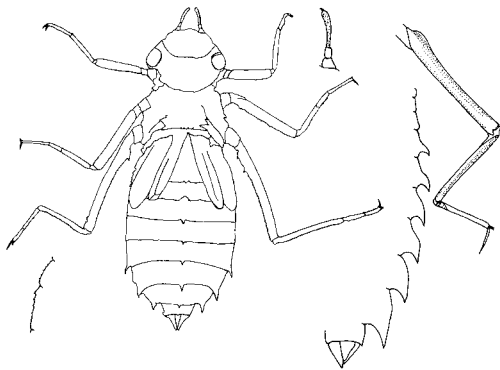


Fig. 3.2.786 *Archaeogomphus nanus* larva (left to right): lateral margin on third and fourth abdominal segments, habitus, antenna, dorsal profile of abdomen, and hind leg. Based on Belle (1970a).

Key to the adults of the genus *Epigomphus* in South America

Information for the key was provided by Calvert (1920), Needham (1944), Fraser (1947b), Santos (1968d), and Belle (1970a, 1988b). The female *Epigomphus pechumani* and male *Epigomphus obtusus* have not been described. Enough information is not available to provide a key to the larvae.

1. There is a well-developed tubercle posterior to and higher than each lateral ocellus (**Fig. 3.2.787**). The light dorsal markings on the synthorax of the female consist of two narrow pale green or yellow antehumeral stripes, one near the humeral suture.

.....*Epigomphus armatus* Ris, 1918
(Costa Rica, Peru).

- There is no tubercle posterior and dorsal to each lateral ocellus (**Fig. 3.2.788**). The light markings on the synthorax do not form two narrow stripes.2

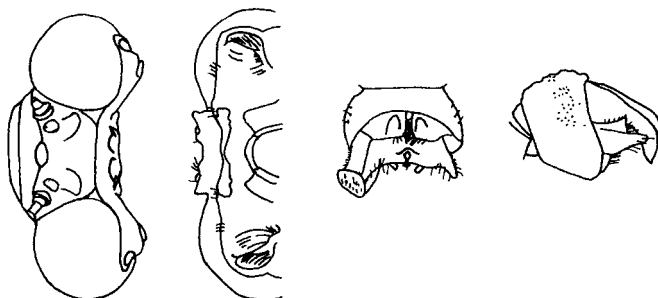


Fig. 3.2.787 *Epigomphus armatus* left to right: head of a female in dorsal and posterior view, and the apex of the male abdomen in ventral view with one of the superior anal appendages removed and in lateral view. Based on Calvert (1920).

2. The tenth abdominal segment has a large mid-dorsal process that is covered with a patch of small black spines and divided into two humps along the midline (**Fig. 3.2.788**).3

- If the tenth abdominal segment has a middorsal process covered with a patch of spines, it is not divided into two humps along the midline. The inferior anal appendage is only slightly longer or shorter than the superior appendage. The light markings on the thorax consist of at least one narrow stripe and a spot (**Fig. 3.2.789**).4

3. The two humps on the tenth abdominal segment of the male are large and divided by a narrow midline depression. The height of these humps is variable. The inferior anal appendage of the male is longer and broader than the superior appendage, longer than the tenth abdominal segment, and has a dorsal subapical tooth on each of its lateral processes. The light dorsal markings on the synthorax

consist of two wedge-shaped markings and two small circles near the posterior margin (**Fig. 3.2.788**). Length of abdomen: 37 to 45 mm. Hind wing length: 33 to 36 mm.

.....*Epigomphus paludosus* Hagen in Selys, 1954 (Argentina, Paraguay, Minas Gerais, São Paulo).

- The two humps on the tenth abdominal segment of the male are very low and divided by a rather broad depression; in dorsal view, they appear as two elliptical areas of black spines, narrowly contiguous along the midline. The occipital plate has a deep groove on each side. The inferior anal appendage of the male is almost as long as the the superior appendage, which is as long as the tenth abdominal segment (**Fig. 3.2.790**). The light dorsal markings on the synthorax consist of two narrow green stripes, which diverge toward the head, and a green spot on each side. The mesepimeron is mainly green. Total length: 47 to 49.5 mm. Length of abdomen: c. 37.5 mm. Hind wing length: c. 31.5 to 32 mm. Length of pterostigma: 3.1 to 3.2 mm.

.....*Epigomphus occipitalis* Belle, 1970 (Peru).

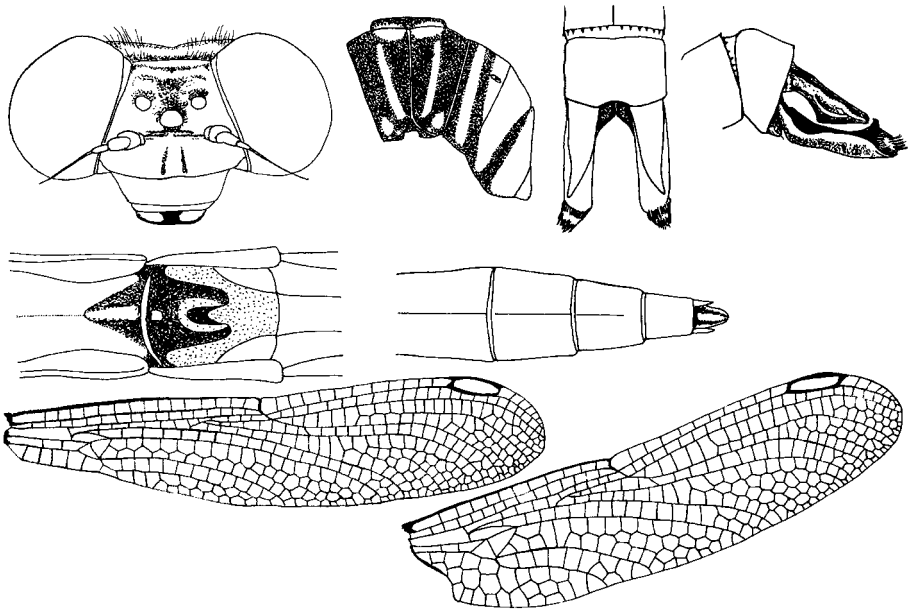


Fig. 3.2.788 *Epigomphus paludosus* (upper row, left to right): head of a female in anterior view, diagram of the color pattern on the synthorax of a female, apex of the male abdomen in dorsal and lateral view, and vulvar lamina on the ninth abdominal segment of a female in ventral view (middle left), apical segments of the female abdomen in dorsal view (middle right), and fore (lower left) and hind wing (lower right). Based on Needham (1903) and Fraser (1947b).

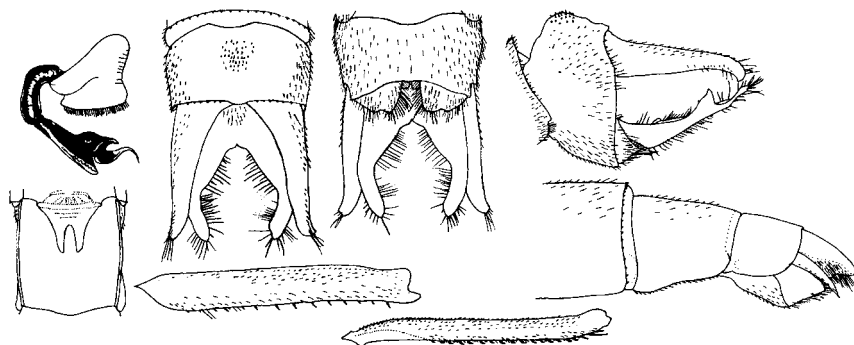


Fig. 3.2.789 *Epigomphus llama*: penis in lateral view (upper left), hind femur of a female (lower left center), hind tibia of a male (lower left center), apex of the male in dorsal, ventral, and lateral view (above, left center to right), apex of the female abdomen in lateral view (lower right), and the vulvar lamina on the ninth abdominal segment of a female in ventral view (lower left). Based on Fraser (1940) and Belle (1970a).

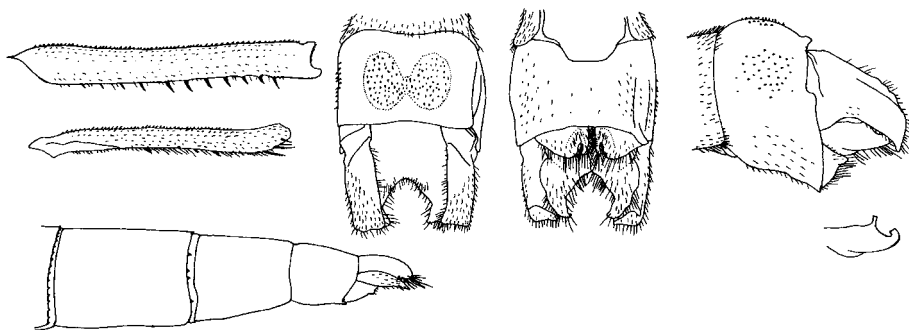


Fig. 3.2.790 *Epigomphus occipitalis*: hind femur of a female (upper left); hind tibia of a male (middle left); apex of the male abdomen in dorsal (left center), ventral (right center), and lateral view with the apex of the inferior anal appendage concealed (upper right); apex of the inferior anal appendage in lateral view (lower right), and the apex of a female abdomen in lateral view (lower left). Based on Belle (1970a).

4. There is one distinctive middorsal hump or a pair of them covered with small spinules on the tenth abdominal segment and a dorsal subapical tooth on the inferior anal appendage of the male (**Fig. 3.2.789**). 5
- If there is a patch of small spinules on the tenth abdominal segment, it is not elevated on a process or a swelling (**Fig. 3.2.791**). 6

5. The vulvar lamina on the ninth abdominal segment of the female is narrowly and deeply invaginated along the midline (**Fig. 3.2.789**).

.....*Epigomphus llama* Calvert, 1903
(Bolivia, Peru).

- The dorsal swelling on the tenth abdominal segment begins at the anterior margin of the segment. The apex of the superior anal appendage is emarginated. The dorsal tooth on the inferior anal appendage is situated less than 2/3 of the way from the base of the appendage to the apex. The middle penis segment is produced at the apex and forked, with the branches of the fork shaped like small ears (**Fig. 3.2.792**). Total length of male: c. 52 mm. Length of male abdomen including appendages: c. 40 mm. Hind wing length of male: c. 34.5 mm. The head and thorax of the male are mainly brown and green. The male abdomen is dark green with some green and yellow markings. The hump on the tenth abdominal segment is reddish brown. The female has not been described.

.....*Epigomphus gibberosus* Belle, 1988
(Peru).

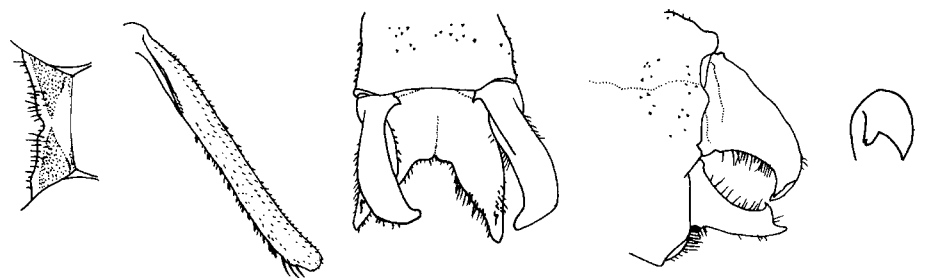


Fig. 3.2.791 *Epigomphus pechumani* male (left to right): occipital plate in dorsal view, apex of abdomen in dorsal and lateral view, and apex of the superior anal appendage in posterior view. Based on Belle (1970a).



Fig. 3.2.792 *Epigomphus gibberosus* male (left to right): apex of the male abdomen in lateral view, apex of a superior anal appendage in posterior view, inferior anal appendage, and apex of the middle segment of the penis. Based on Belle (1988b).

5. Males	6
- Females	7

6. The superior and inferior anal appendages are relatively narrow, both at least twice as long as the width at the base (**Fig. 3.2.793**). The abdomen of the male is blackish with vague lighter lateral areas on the first to third segments and lighter color on a tubercle on the tenth abdominal segment. Length of abdomen: c. 44 mm. Hind wing length: c. 35 mm. Length of pterostigma: c. 3.5 mm.

.....*Epigomphus hylaeus* Ris, 1918
(French Guiana, Surinam, Ecuador, Peru, Rondônia, Amazonas, Pará, Mato Grosso). Syn: *Epigomphus gracilis* Belle, 1970.

- The superior and inferior anal appendages are thick, both less than twice as long as the width at the base (**Fig. 3.2.791**). The female has not been described.

.....*Epigomphus pechumani* Belle, 1970
(Colombia).

7. The light dorsal markings on the synthorax consist of a narrow sigmoid stripe and two small circles near the posterior margin (**Fig. 3.2.590**). The male has not been described.

.....*Epigomphus obtusus* Selys, 1869
(Colombia, Ecuador, Peru, Brazil).

- The light markings on the synthorax consist of a thin anterior collar, a very narrow antehumeral stripe separated from it, and an antihumeral fleck. The head, thorax, femora, and two basal abdominal segments are mainly light brown, and the third through tenth abdomen segments are black with brownish anterior margins on the third through seventh segments of the female. The vulvar lamina on the ninth segment of the female is yellowish brown, has a pair of thin processes, and covers about 2/3 of the length of the segment (**Fig. 3.2.793**). The wings are hyaline, and the pterostigma is blackish brown. Length of abdomen: c. 44 mm. Hind wing length: c. 35 mm. Length of pterostigma: c. 3.5 mm.

.....*Epigomphus hylaeus* Ris, 1918
(French Guiana, Surinam, Ecuador, Peru, Rondônia, Amazonas, Pará, Mato Grosso). Syn: *Epigomphus gracilis* Belle, 1970.

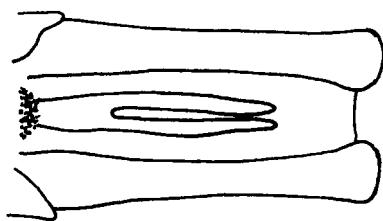


Fig. 3.2.793 The ninth abdominal segment of a female *Epigomphus hylaeus*, showing the vulvar lamina. Based on St. Quentin (1973).

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